ENGINEERING CONSTRUCTION WEEKLY

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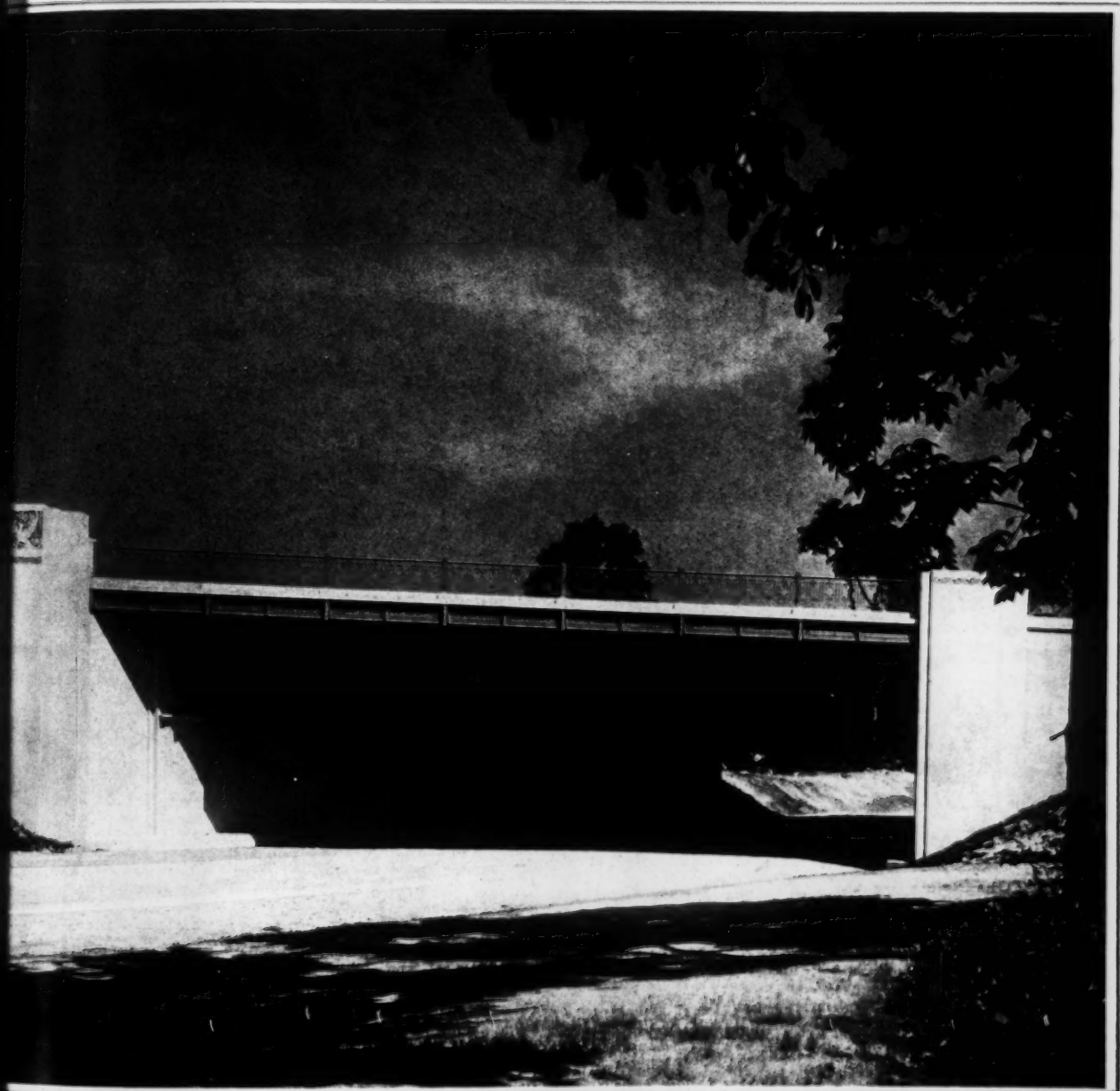
Engineering NEWS-RECORD

September 23, 1937



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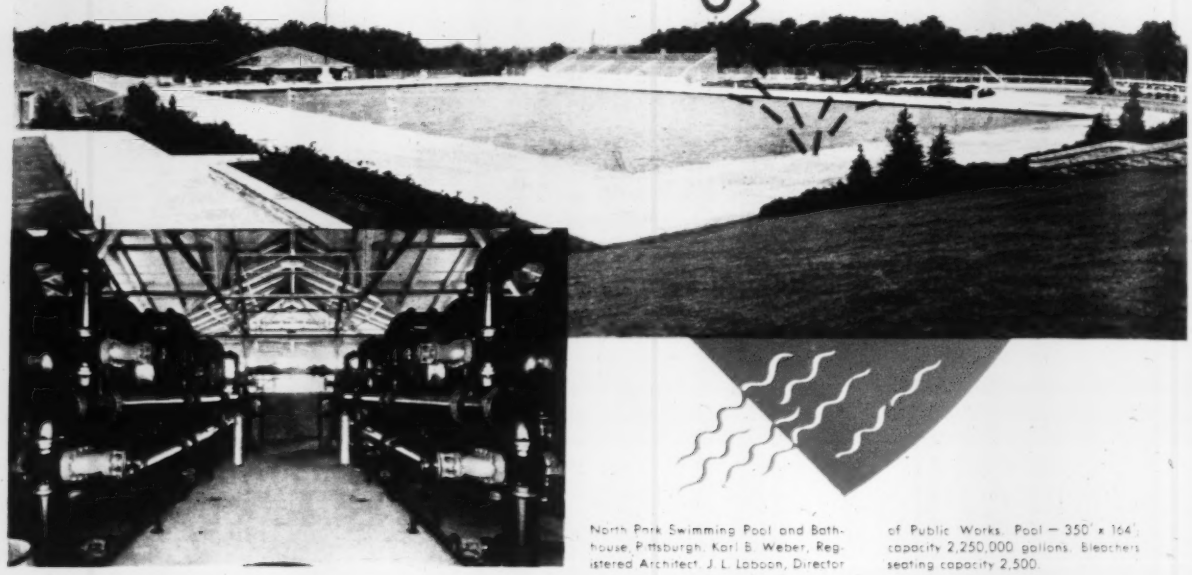

North Park Swimming Pool and Bathhouse, Pittsburgh. Karl B. Weber, Registered Architect. J. L. Laboon, Director of Public Works. Pool — 350' x 164', capacity 2,250,000 gallons. Bleachers seating capacity 2,500.

● You never think of corrosion around a swimming pool unless you're responsible for its construction or maintenance—and then you know it's a serious problem unless you use material that will resist it.

Knowledge of the conditions and experience with Wrought Iron's long life under these conditions was the reason so much Byers Wrought Iron was used in the North Park Swimming Pool and Bathhouse recently completed in Pittsburgh.

Whether you are working on a swimming pool or some other project, the many uses made of Byers Wrought Iron in this installation will show you where you should give it consideration. Byers Wrought Iron Pipe was used for all raw water supply lines, return lines from pool, scum gutter lines, recirculation lines, suction lines, waste lines, vents and leaders in bathhouse. Also all railings and stairway to observation platform were made of Byers Wrought Iron pipe, plates and bars.

Wherever corrosion is a problem be sure you review wrought iron's record before specifying the material. If there is any question about corrosive conditions let us work with you in making a corrosion study. Complete information and engineering assistance are readily available through our nearest Division Office or from our Engineering Service Department in Pittsburgh. A. M. Byers Company. Established 1864. Pittsburgh, Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco.

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TUBULAR AND FLAT ROLLED PRODUCTS

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What Makes Pikes Peak?

WINDING THROUGH the foothills, the train swung into its gruelling climb to the Continental Divide. In the observation car eager tourists craned this way and that in their zeal to miss none of the scenic wonders. The news-butcher, shrewdly building up to his climax of souvenir postcards and booklets, pattered away about this feature and that. Suddenly, dramatically, he declaimed:

"And there, away off in the distance like a cloud against the sky, is Pikes Peak!"

With excited exclamation, the avid sight-seers turned in unison to peer at that dim outline. It was a big moment of their trip. But, incidentally, it was not Pikes that received their tribute. That day Pikes was lost in a haze. But what matter? They wanted to see Pikes; the news-butcher knew that they wanted to see Pikes; so Devil's Head could pass muster as Pikes for that trip. Everyone was happy and none disappointed. They had seen Pikes Peak!

IT IS REMARKABLE, the hold of that mountain on the popular mind. Any number of Americans will name it without hesitation as the highest peak in the United States yet it falls far short of that distinction. It is topped by more than two dozen mountains in Colorado alone, to say nothing of the champion Whitney in the Sierras. Yet, when it comes to mountains, the man on Main Street rates Pikes as tops.

Why?

Well, for several reasons. First, it really is a noble peak. Rising almost sheer from the plains, its majestic height and bulk dominate its surroundings. Pikes need not be highest to rank among the most imposing of peaks; by any standard it rates that.

Moreover, it is happily named. Short, snappy, with all the power of "apt alliteration's artful aid," Pikes Peak is a name soon learned and long remembered. It, too, has had much to do with the popularity of the mountain.

Then, too, Pikes Peak is accessible. It is well forward in the Front Range, close to a thriving and popular city, scaled by railway and motor highway without effort or hazard and not too far from the thickly-populated East. Pikes is within easy reach of many.

Then, most important of all, it has been well advertised. Probably no other mountain ever has had its name in the hearts and minds and on the lips of so many people. In the early days of western exploration it was a widely known landmark. The covered wagons of the first Colorado gold rush displayed to all the legend "Pikes Peak or Bust," even though the diggings actually were many miles away. Newspapers, politicians and preachers, tongue, press and pen, all described the new El Dorado as the "Pikes Peak Country." Years later, the Cripple Creek strike fanned into new flame the still glowing embers of its fame. Pikes Peak has been consistently advertised.

So Pikes Peak has come to reign as our number one mountain. The average American has heard of it all his life, he remembers it, it is within his easy reach, it doesn't let him down when he finally gets there.

AND RIGHT THERE is found a formula for any form of popularity. It is the formula by which any American business can put its products on a Pikes Peak basis. What happened by chance to a mountain can be applied by conscious design to human enterprise. And not one factor can be slighted without risking either failure or excessive cost.

The capable business man tries to produce a worthy product that will not disappoint his customers; he seeks a name for it that will catch on and be easily remembered; through sound pricing and distribution policies he would make it readily available to the largest possible number. And, finally, he knows that he must advertise it intelligently and consistently.

The advertising pages of this and comparable journals bear witness to the standing of many firms and products that have achieved Pikes Peak stature. They may or may not be the biggest of their kind; they may excel or be surpassed in this or that particular. But, in any case, they have won by due attention to this formula some measure of the popularity and recognition that chance, working through the same formula, has bestowed upon a masterpiece of nature.

Willard Chevalier

ENGINEERING NEWS-RECORD

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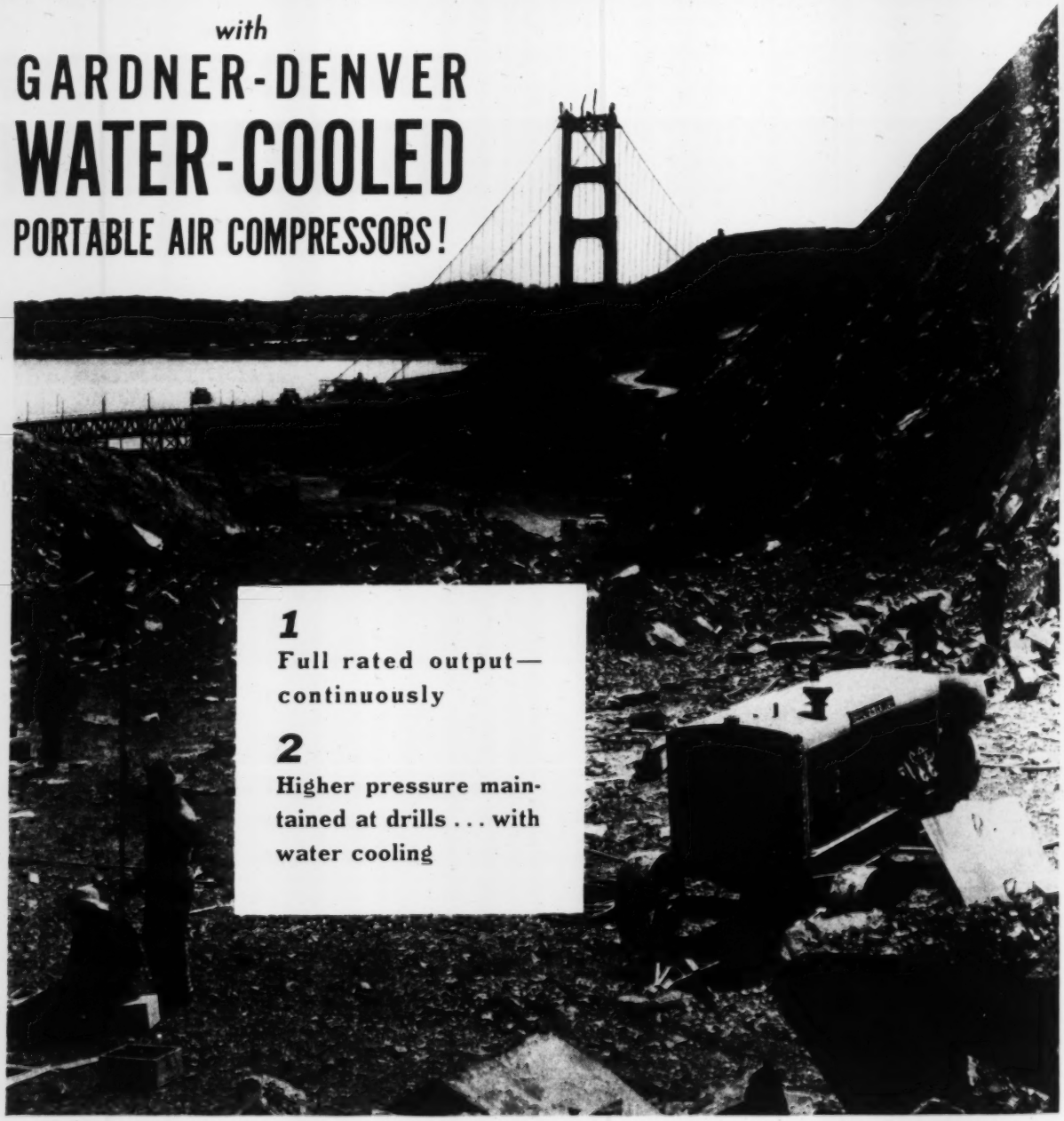

Gardner-Denver 315 Portable Compressor powered with a "Caterpillar" Diesel Engine on Macco Construction Co. contract for approach to Golden Gate Bridge.

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· ENGINEERING NEWS-RECORD ·

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F. E. SCHMITT, *Editor* ALBERT E. PAXTON, *Manager*

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VOL. 119 *SEPTEMBER 23, 1937* No. 13

THIS WEEK AND NEXT

CONSTRUCTION of 70 bridges on Connecticut's Merritt Parkway will require a variety of surface treatments. L. G. Sumner, State Highway engineer of bridges and structures, describes the use of ornamental precast concrete in accomplishing this end on the rigid frame structures.

A test program carried out at the Massachusetts Institute of Technology reveals interesting new data with respect to building floors made of precast units and poured ribs. A description of the tests and a summary of the results are given by Professors Holmes and Protze.

Structural welding, in the eleven years since it was first used on a major structure, has developed into an established art, well-known to some but still looked upon with suspicion by others. Its approval by the new building code of New York City makes its advantages and limitations of moment to a vast new audience. Where structural welding stands today is told in an authoritative article by Gilbert D. Fish, chairman of the building code committee of the American Welding Society.

Chicago builders have long contended that the city's obsolete building code has been an insurmountable obstacle to anything like a building boom. Piecemeal passage of various chapters is the latest strategy developed to speed action.

An insider observes that WPA should get out of the construction game, and that cities not yet ready to continue their own public works should be aided by PWA.

L. A. S. Wood has written "Road Lighting for Seeing," the fourth in Engineering News-Record's *highway lighting series.*

NEXT WEEK—An issue of special interest to engineers and administrators engaged in building better cities.

		PAGE
The Week's Events		489, 526
Reader Comment		496
Editorials		498
Pictures in the News		500
Bridges on the Merritt Parkway	L. G. SUMNER	501
(Concrete rigid frames, Parkways, Ornamental precast concrete)		
Federal Housing and the City Plan		506
Precast Concrete Floor Slabs	ADDISON F. HOLMES and HERMAN G. PROTZE, JR.	507
(Building construction, Unit-and-joist floors, Concrete testing)		
Welding for New York Buildings	GILBERT D. FISH	508
(Structural steel, Welding design, Supervision, Fabrication, Field of Use)		
New Chicago Building Code		511
(Loads and Stresses, Foundations, Timber, Reinforced Concrete)		
The Case for WPA		514
Road Lighting for Seeing	L. A. S. WOOD	516
(Factors affecting visibility on various surfaces)		
Montana Bituminous Conference		521
Texas Gets Better Roadsides	WINTON WATKINS	522
Current Sewage Disposal Notes		523
Field and Office Notes		524
Unit Prices	*Adv.page*	20
New Aids to the Constructor	*Adv.page*	22
Construction Reports	*Adv.page*	27

COVER PICTURE—One of the 70 bridges that are being built on the 38-mile Merritt Parkway in Fairfield County, Conn. This structure carries the parkway over an intersecting road.

Number of copies of this issue printed: 28,973

Not a Vitamin in the lot . . . *yet* that doesn't prevent a fellow from writing an advertisement about ATLAS GELODYN

WE CAN'T "talk about taste or flavor"—but the story of Atlas Gelodyns is a story to "whet the appetite" of any contractor who *thinks in terms of saving.*

Where gelatin type explosives are involved, Atlas Gelodyns, semi-gelatinous type explosives, effect worth-while economies on many jobs.

In the first place, a case of Atlas Gelodyn No. 3 averages 120 cartridges instead of about the 95 cartridges you'll find in a 50-lb. case of standard 40 and 50% ammonia gelatin explosives and Gelodyns can often be substituted stick for stick. Second—Atlas Gelodyns provide better water resistance than non-gelatinous explosives.

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THE WEEK'S EVENTS

Schley Is Appointed Chief of Engineers

Former governor of Panama Canal will assume post to be vacated by Markham

Effective Oct. 18 Col. Julian Larcombe Schley will become Chief of Engineers of the U. S. Army with the rank of Major General. Col. Schley is best known in engineering circles for his work as engineer of maintenance and as Governor of the Panama Canal. The Madden Dam was built during his administration. He organized the design office and started the studies for the third series of lock chambers.

While serving as assistant to the Engineer Commissioner of the District of Columbia in 1913, Col. Schley formulated the plan for regulating utilities in the District of Columbia and was the executive officer of the first Public Utilities Commission from 1913 to 1916.

Familiar with Mississippi

In choosing Col. Schley, President Roosevelt selected an officer who is very familiar with the flood control problem on the Mississippi River. For two years, 1916 and 1917, Col. Schley was in charge of the New Orleans engineering district. Later while serving as district engineer at Galveston he served on the spillway board which recommended the construction of the diversion at Bonne Carre and various improvements in the Atchafalaya Basin. He was on the river continuously during the 1927 flood and had an opportunity to observe that catastrophe at first hand.

Early studies of the intercoastal canal across southern Louisiana were made under Col. Schley's direction. He was in immediate charge of the work in Southwest Pass which overcame the tendency to shoal in that mouth of the Mississippi River.

Execution of the Houston ship canal was under the personal direction of Col. Schley as was the Corpus Christi channel. He built the first jetties at Port Isabel, Tex.

Col. Schley was born in Savannah, Ga. in 1880. He entered the U. S. Military Academy in 1899. On receiving his commission in the Corps of Engineers he was sent to the Philippine Islands. Later he served with engineer troops at Fort Leavenworth. From 1905 to 1909 he was on duty with the army of pacification in Cuba.

After taking a post-graduate course in engineering he went to the U. S. Military Academy as instructor. During the World War Col. Schley commanded the 307th regiment of engi-

(*Continued on page 493*)

Harris & Ewing Photo

COL. JULIAN L. SCHLEY
New chief of U. S. Engineers

MAJOR NEWS

	Page
New Chief of Engineers	489
Tax Exemption of Federal Contractors	489
WPA and City Jobs	490
Horace Harding Boulevard	490
Urban Problems Report	492
Apprentice Engineers	493
Attack on Public Power	493
Earth Dam Progress	494
Kansas Dam Fails	495

Tax-Exemption End Urged

Attorney-General argues that contractors on federal projects are not exempt from state taxes.

Willingness on the part of the federal government to end the immunity to state taxation heretofore enjoyed by those supplying it with goods and services, and by inference the corresponding exemption from federal taxation of those supplying local and state governments, has been expressed in a brief filed by Attorney-General Cummings with the U.S. Supreme Court. (*ENR*, Sept. 16, 1937, p. 449.)

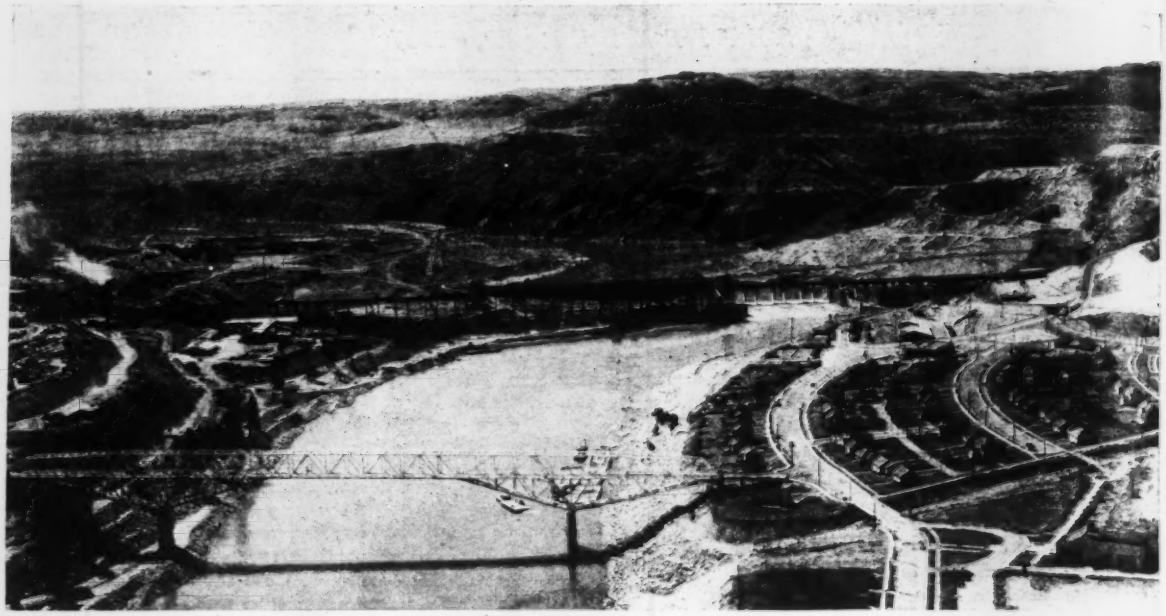
The brief affects three pending cases in which, respectively, the state of West Virginia is attempting to tax payments to the Dravo Contracting Company for dam construction on the Ohio and Kanawha Rivers, and the state of Washington is suing to collect taxes from the Silas Mason Company and David H. Ryan, contractors on the Grand Coulee Dam. All were argued this spring before the Supreme Court, but the United States, not being a party, did not appear. The Court requested the Attorney-General to present the views of the federal government and set the cases down for re-argument this fall.

History of doctrine

The exemption doctrine is not based upon any specific section of the Constitution, but was early formulated by judicial decision as a necessary protection for the dual system of government, on the principle that "the power to tax is the power to destroy." The brief points out, however, that the United States cannot complain of being required to enter the market place on a par with all other purchasers subject to a non-discriminatory tax—i.e., one directed, not at the federal government, but at the contractor. Admittedly this will increase the cost of federal purchases, but the point is made that state laws other than tax laws often have the same effect, and have never been ruled unconstitutional for this reason.

Upholding of the Attorney-General's

(*Continued on page 495*)



COLUMBIA RIVER TO BE MOVED AGAIN

As the high water of summer rapidly recedes, the cofferdams at Grand Coulee which exclude the Columbia River from its natural course and force it through low gaps in the west end at the base of Coulee Dam are being cut down. Preparations are under way to close the diversion channel and turn the flow of the river through gate-controlled outlet tunnels in the central section of the dam which can be seen in the middle distance.

By next spring, the base of the dam will span the canyon. The finished dam will rise 300 ft. above the base.

Indiana Cities Are Ordered To Stop Lake Pollution

The industrial cities of Indiana bordering on Lake Michigan were ordered on Sept. 15 to cease polluting the lake with their sewage. The state department of commerce and industry issued the order to take effect Jan. 1, 1939. The order follows an exhaustive pollution survey recently completed which indicated, as have many others over the last 30 years, that the sewage of Indiana cities under adverse northern winds, moves northward toward the intake crib of the Chicago water supply.

Necessity of curtailment of the lake diversion at Chicago on the Calumet as well as the Chicago River to a combined total of 1,500 sec.-ft. has increased Illinois activity in urging Indiana to cease dumping sewage into their common water supply. Recent completion of interceptors on the Illinois side diverting all of its sewage away from the lake has enabled that state to come into conference with clean hands and put it in a position to start a suit in the federal court against Indiana to force it to stop polluting Lake Michigan.

In consequence, the present order, similar to one of ten years' standing issued by the Indiana state board of health, is more likely to bring about action. Gary, Hammond, Whiting and East Chicago, the cities in question, each has long had plans for sewage disposal under consideration. Hence the first steps essential to the program are financial and legal, engineering preliminaries having largely been completed.

• • •

City Work Done by WPA Studied in New York

An analysis of the work done by the 110,000 WPA workers now assigned to New York City departments to determine which of these jobs should be filled by city employees rather than WPA workers is to be undertaken by a special committee appointed Sept. 19 by Lt. Col. Somervell, New York City WPA Administrator. The committee is made up of a representative of the city and members from the division of operations and the division of women's and professional projects of WPA.

Colonel Somervell announced that when the findings are complete he will confer with the mayor on a program for withdrawing WPA funds from jobs which violate the relief regulations against performance of regularly budgeted municipal work with relief funds.

Horace Harding Boulevard Opened in New York

Horace Harding Boulevard in the borough of Queens, New York City, near the site of the 1939 New York World's Fair between Queens Boulevard and the east end of Flushing Meadow Park, was opened Sept. 18. The new highway provides twin concrete roadways from Queens Boulevard for a distance of 2 miles easterly through the Flushing meadows, where it connects with an older section of Horace Harding Boulevard which was paved in 1928. The section through Flushing Meadows Park passes over the Grand Central Parkway extension on a two span bridge, under a pedestrian bridge provided by the World's Fair, and over Flushing Creek on a 7-span structure.

Construction of the highway cost $2,037,000, of which $922,000 was for bridges. Right-of-way for the highway cost $900,000. Construction was financed by the New York state department of public works and carried on under the supervision of the New York City parks department. Madigan-Hyland and Moran, Proctor & Freeman were consultants on the project. Contractors on the work were Johnson Drake and Piper, Inc.; Charles F. Dachris, Inc.; Faircroft Engineering Corp.; and O'Driscoll and Grove.

THE CURRENT TREND

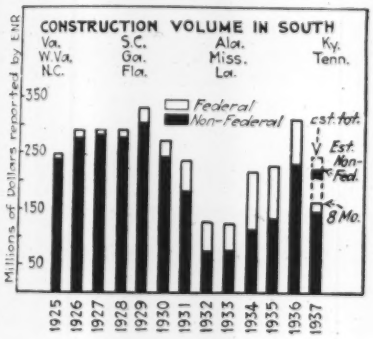
This week's news of contract volume and construction cost factors

Construction in the South

Ten per cent of this year's construction volume is in the South. This is a return to pre-TVA days when the eleven southern states contributed from 8.1 to 10.5 per cent of the national total of engineering construction. TVA and other federal expenditures sent South's percentage up to 15.8 when all classes of work were low except those federally financed.

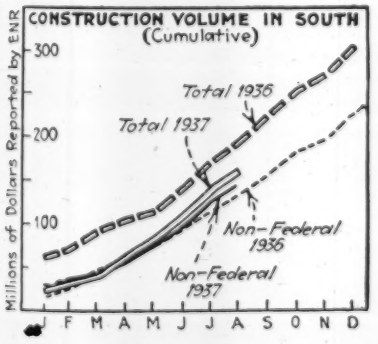
Peak dollar volume in the South, as reported by *Engineering News-Record* in 1929, was $330,000,000 with 1936 second high at $309,000,000. Due to lower federal commitments for construction, the volume recorded this year is lagging 15 per cent behind last year. Non-federal public and private work, however, is running about even with last year.

South's industrial building has returned to the spectacular heights of

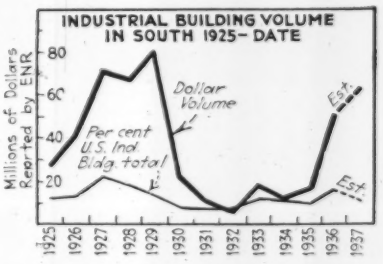


the late twenties in dollar volume. It ranges between 10 and 15 per cent of the U. S. total.

In the first 8 months of this year the eleven southern states produced 7 per cent of water works construction, 4 per cent of sewerage and waste disposal, 18½ per cent of bridge, 8 per cent of earthwork and waterway, 17 per cent of highway, 11 per cent of industrial building, also 11 per cent of



public building, 4 per cent of commercial building and 4 per cent of unclassified construction. Of private con-



struction, 7 per cent, of public construction, 12, comes this year from the Southern States.

• • •

Wholesale Price Index

The Bureau of Labor's building materials price index, up 2½ per cent since January and 11 per cent higher than the average for last year, dropped a fraction of a point in August due to a lower lumber index. Other components show stability or slight gains. Relative positions of the components making up this index are given in the accompanying table based on 1926 = 100.

BUILDING MATERIALS WHOLESALE PRICE INDEX

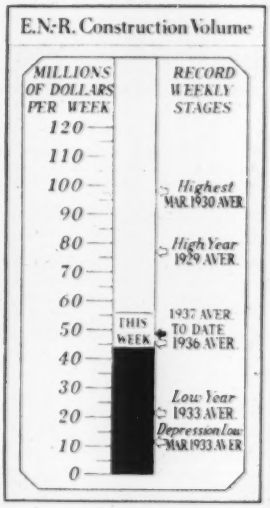
1926=100	1936 Aver.	1937 July	1937 August
Brick and tile	88.7	95.4	95.5
Cement	95.5	95.5	95.5
Lumber	84.5	101.3	99.5
Paint and paint materials	80.1	83.9	84.1
Plumbing and heating materials	75.0	78.7	78.8
Structural steel	95.0	114.9	114.9
Other building materials	90.2	101.0	101.0
All building materials	86.7	96.7	96.3

• • •

Construction Briefs

RENTS continue upward, have increased 0.8 per cent from July to August, are now 10.7 per cent higher than in August, 1936, 40.0 per cent higher than in January, 1934, their low point, and only 4.6 per cent lower than in August, 1929—National Industrial Conference Board.

IN THE ENTIRE URBAN AREA of the United States 118,597 new dwelling units were provided during the first half of 1937, according to U. S. Bureau of Labor Statistics. This is an increase of more than 33,000 units or 39 per cent compared with the corresponding



THIS WEEK'S FIGURES

(Thousands of Dollars)

CONTRACTS

	Week Ending Sept. 24 1936	Sept. 16 1937	Sept. 23 1937
Federal	$5,501	$5,528	$2,138
State & mun. bonds	377,276	396,178	
Total public	$31,218	$26,566	$25,894
Total private	36,823	20,781	17,783
TOTALS	$68,041	$47,347	$43,677
Cumulative 1937 (38 weeks)			$1,845,014
1936 (39 weeks)			$1,737,659

Note: Minimum size projects included are: Waterworks and waterways projects, $15,000; other public works, $25,000; industrial buildings, $40,000; other buildings, $150,000.

NEW PRODUCTIVE CAPITAL

	Cumulative 1936 39 Wks.	1937 38 Wks.
NON-FEDERAL	$690,309	$1,244,260
State & mun. bonds	377,276	396,178
Corporate securities	201,598	440,597
PWA loans, grants	86,527	177,546
RFC loans	24,998	29,939
Fed. aid for highways		200,000
FEDERAL	$691,237	$746,223
TOTAL CAPITAL	$1,381,636	$1,990,483

ENR INDEX VALUES

Index Base	1913	1926
Construction Cost (Sept.)	243.95	117.27
Construction Volume (Aug.)	150.	66.

period of 1936. These estimates are based on reports received from more than 1,500 cities having a population of approximately 59,000,000 or 85 per cent of the urban population, according to the 1930 census. Cities of all sizes registered gains in the number of family dwelling units provided, but the rate of increase was somewhat greater in cities having a population of less than 25,000 than in the larger cities. All geographic divisions shared in the increase. The most pronounced gain was registered in the Pacific Coast States.

Urban Problems Reported On

Subcommittee of National Resources Committee analyes special problems of municipalities

Raising the question whether the federal government has given sufficient attention to the special problems of urban dwellers in comparison to the attention given through the Department of Agriculture to rural problems, the committee on urbanism of the National Resources Committee submitted a report Sept. 20 on "Our Cities, their role in the national economy."

It is pointed out that this country has undergone an unprecedentedly rapid shift from a predominantly rural to an urban status. Where in 1880 only 26 per cent of the total population were urban dwellers, this proportion had risen to 56 per cent in 1930. At the same time the development of faster forms of urban and interurban transportation have led to a great growth of suburban areas, so that, in 1930, 54 per cent of the nation's population lived in the 96 metropolitan districts with at least 100,000 inhabitants each. In 1929 74 per cent of all industrial wage earners, 81 per cent of all salaried employees, 79 per cent of all wages paid, and 65 per cent of all industrial establishments were included in the 155 counties which contained the larger industrial cities.

Special problems

The report finds that a number of special problems are characteristic of urban areas. Drastic inequalities of income and wealth are most marked there. Industries within a particular city frequently fail to be coordinated for maximum benefit to the community. Rapid obsolescence of physical plant is a problem which the American city has to face, leaving the traces of small towns in great cities, leaving ghost towns, and resulting in many blighted neighborhoods. Competing forms of transportation, giving an advantage now to one neighborhood and now to another, have intensified this.

Uncontrolled subdivision and speculative real estate activities have weakened the taxation structure of cities. Urban housing is a very burdensome problem, with rentals so high that they exclude many urban families from housing facilities of minimum standards, thus intensifying another urban problem—low public health.

Control of crime and financing of public activities also present special problems to urban communities, while the political structure by which cities are governed has not been modified to meet changed conditions.

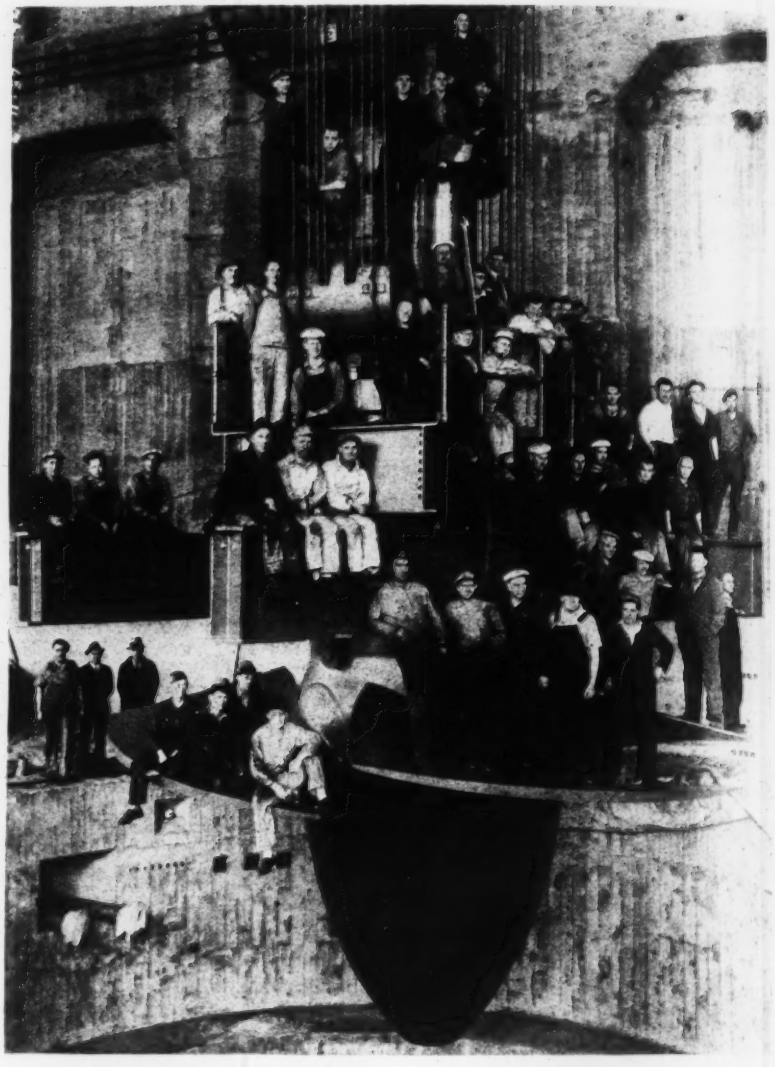
Recommendations

On the basis of its findings and as a possible solution for these problems the committee makes a number of recommendations:

It is recommended that the United States study and act upon the problems of chronically depressed urban areas and continue its policy of cooperation with and assistance to the social welfare programs of urban communities, particularly in relation to the relief of unemployment.

A section for urban research to be set up in some suitable federal agency is recommended which could perform for urban communities functions similar to those now performed for rural communities by the Department of Agriculture. In this connection it is recommended that a clearing house of urban information be created in the Bureau of the Census and that the Central Statistical Board give consideration to inadequacies in urban data.

It is recommended that consideration be given to the creation of a federal credit agency which would make loans and grants to local governments in periods of economic distress. It is also recommended that Congress establish a permanent federal public works authority and that a policy be adopted for rehousing low income groups as a cooperative undertaking among federal, state and local governments and private enterprise.



AN EXPENSIVE ELEVATOR

LOWERING the Bonneville turbine runner, 23 ft. 4 in. in diameter, into place in the Bonneville power house. The capacity of this unit is 66,000 hp., making it the highest powered unit of the Kaplan type ever built, and it is larger in diameter than any hydraulic runner previously built in the United States. The turbines were described in *Engineering News-Record*, May 27, 1937.

A comprehensive inquiry should be made into conflicting fiscal policies and taxation in local, state and federal governments. The federal government should cooperate in the enactment and administration of uniform criminal laws and interstate crime compacts and also in programs directed toward crime prevention.

It is recommended that Congress pass legislation giving advance consent to and laying down conditions for interstate compacts enabling communities within the same metropolitan region but in separate states to deal jointly with their common problems.

Planning activities

The report recommends that a permanent planning board should engage in a number of activities of benefit to urban communities: encouragement of state, regional, and local planning agencies; improvement of the long-range programing of public works in cooperation with local planning agencies; cooperation with industrial communities in efforts to plan improvements in the soundness and stability of their industrial structure; to prepare the general plan of a coordinated transportation system; and to inquire into the effects on urbanization of the wider distribution of electric power.

In order to raise the standards of urban public service, the report recommends that states and communities using federal grants-in-aid should be required to conform to minimum personnel standards under the merit system. The federal vocational training work should be extended to cover public service occupations. And the U. S. Civil Service Commission should furnish eligible lists to local authorities and prepare model personnel standards applicable to the same classes of positions on all levels of government.

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Schley Is Appointed Chief of Engineers

(*Continued from page 489*)

neers and later was engineer for the Fifth Corps of the American Expeditionary Force. After the war he returned to Washington.

In 1921 and 1922 Col. Schley was in charge of the Nashville Engineering District, where he had charge of improvement and maintenance on the Tennessee River below the Wilson Dam. From 1922 to 1924 he was assistant commandant of the engineer school at Fort Humphreys. His service at Galveston followed that assignment after which he was sent to the Canal Zone. Since 1936 Col. Schley has been commandment of the engineer school at Fort Belvoir, Va.

New Court Attacks Made On Public Power

Adding another item to the long list of pending cases challenging PWA loans to municipalities for power purposes, the Northwestern Public Service Company, Inc., Sept. 20 applied to the U. S. District Court for the District of Columbia for an injunction to prevent Administrator Ickes from disbursing a $400,000 PWA allotment to the city of Columbus, Nebraska, for the construction of a municipal distribution system and street lighting system. The grant of $180,000 and loan of $220,000 was announced August 24, 1937 as part of the new PWA program covering "moral obligation" projects.

On Sept. 6 an appeal was filed in the Tennessee Supreme Court by the Tennessee Public Service Co. challenging Chancellor Mitchell's action of last April in dismissing an injunction which prohibited the city of Knoxville from building a municipal power distribution system. The appeal attacks the validity of the TVA, the PWA, and state legislative acts regarding TVA.

The same questions were raised in an original injunction against the city in 1934 but were later dismissed by the State Supreme Court.

Test cases raising the same issues are now awaiting argument before the U. S. Supreme Court and a decision is anticipated this fall.

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PWA Allotment Made for Grand River Dam

The PWA has announced presidential approval of an allotment of $20,000,000 to the Grand River Dam Authority of Oklahoma for the construction of flood control irrigation and hydro-electric dam on the Grand River near Pensacola, Okla.

The completed project will provide all the flood control recommended by the U. S. Engineers for the river. It will include a 20,000 kw. hydro-electric power plant capable of delivering about 175,000,000 kw.-hr. of firm power annually. A special survey by the Federal Power Commission has indicted that there is a good market for this power in the surrounding urban and rural area as well as in the oil and coal fields and the lead and zinc mines nearby. The Grand River dam authority was created by the Oklahoma legislature in 1935. At the recent session of Congress, an amendment to the relief appropriation was passed authorizing allotment of PWA funds to flood control projects for which state authorities have been created, and the present allotment is made under the terms of that amendment.

Apprentice Engineers For New York

City will hire ten college graduates to be trained in Board of Transportation

A system of apprentice engineers in the New York City departments is begun in a plan prepared for the Municipal Civil Service Commission by Paul J. Kern, member of the commission. The program calls for employment of ten recent graduates from the engineering department of Columbia, City College, New York University and Cornell as "cadet" engineers for the board of transportation. The plan is intended to attract young men of high scholastic ability and to give them a year of intensive practice in city work.

At the end of a 16 months apprenticeship the cadet engineer would participate in an open competitive examination on the same terms as all other applicants.

Under the plan, the deans of the engineering schools of the metropolitan universities would be asked to nominate three candidates and the dean of engineering at Cornell one candidate, on the basis of scholastic standing and preparation for railroad engineering. The candidates would be subjected to a qualifying examination and those passing would be appointed on a provisional basis at salaries ranging from $1,200 to $1,800.

If the plan proves successful, it is expected to extend it to the engineering sections of other city departments and also to non-engineering employees of the Board of Transportation. It is intended to extend the plan until it includes all classifications in the independent subway system, including conductors and motormen.

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Page Scheduled to Speak At Reclamation Meet

John C. Page, commissioner of the Bureau of Reclamation, will be one of the principal speakers at the annual meeting of the National Reclamation Association to be held in Casper, Wyo. Oct. 12–14.

Commissioner Page's subject will be "Reclamation of Today." It is expected that his address will broadly cover present and possible future reclamation development of the irrigated land states of the West.

The annual convention of the National Reclamation Association is expected to attract 400 to 500 delegates and representatives from the 14 irrigated land states.

Progress Reported On Earth Dams

Of seventeen dams in PWA-assisted program four are completed and eleven underway

Good progress throughout the summer on its program of construction of earth dams was reported Sept. 20 by the Bureau of Reclamation. It was pointed out that although the Bureau's work on large concrete dams overshadows the program for construction of a number of smaller earth dams, four dams of this type have been started and completed since PWA made the first allotment in 1933 to the Bureau of Reclamation for the purpose, eleven have been placed in construction, and at this time preparations are being made to call for bids on the construction of two more.

The Bureau reported that the completion recently of the Pine View dam on the Ogden River near Ogden, Utah, had brought the total of new reservoir capacity added since the construction program was launched to 195,000 acre-ft. Completion of earth dams now under construction will add an additional 1,287,000 acre-ft. of reservoir capacity to protect land in nine states.

Other dams in the program which have been completed are the Agency Valley dam of the Vale project in eastern Oregon, the Hyrum dam on the Little Bear River in Utah, which serves the new Hyrum project, and the Rye Patch dam on the Humboldt River in Nevada.

Four more dams are nearing completion at this time. The Alamogordo dam, a 142 ft. structure on the Pecos River near Fort Sumner, N. M., serving the Carlsbad reclamation project, is 98 per cent complete. The 200-ft. Taylor Park dam of the Uncompahgre project on the Taylor River in western Colorado is 93 per cent complete. Alcova, a part of the new Kendrick project in Wyoming, a 232 ft. structure on the North Platte River near Casper, is 85 per cent complete, and the Moon Lake dam, 90-ft. structure in Northeastern Utah, is also 85 per cent complete.

Seven other earth dams are in various stages of construction. The Island Park dam, which will be 85 ft. high, is a part of the Upper Snake River storage project in Idaho; it is 73 per cent complete. Bull Lake dam, a 75-ft. structure, is 72 per cent complete. It will provide additional water for the Riverton project in Wyoming.

Caballo dam is 50 per cent complete. This 90-ft. dam on the Rio Grande will regulate the river below Elephant Butte dam and provide additional storage for the Rio Grande reclamation project. It is also a part of the Rio Grande rectification program being carried out by the International Boundary Commission.

Unity dam on the Burnt River in eastern Oregon will be 81 ft. high and is now 41 per cent completed. Fresno dam on the Milk River in Montana, 77 ft. high and now 18 per cent complete, will supply additional water for the Milk River reclamation project.

The 120-ft Grassy Lake dam in Wyoming is another major feature of the Upper Snake River project, and Boca dam on the Little Truckee River in California, 110 ft. high, will store water for the Truckee Meadows area of Nevada.

In addition to these dams, the Vallecito dam, a 150-ft. structure on the Pine River in Eastern Colorado, and the Deer Creek dam, a 155-ft. structure serving the new Provo River project in Utah, are expected to be put under way in the near future.

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Last Concrete Poured On Tygart Dam

The last concrete on the Tygart River Dam, the first project in the Pittsburgh flood protection program, was poured Sept 18, as the dam approached completion. Tygart Dam is two miles upstream from Grafton, W. Va. The dam, 209 ft. above the bed of the river and creating a 327,500 acre-ft. reservoir, is described by Colonel Covell, head of the Pittsburgh district, U. S. Engineers, as the largest east of the Mississippi.

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Emergency Council Ended

The National Emergency Council was abolished by President Roosevelt Sept. 20, effective Dec. 31. He directed that its records and equipment be transferred to the Bureau of the Budget, but no mention was made of personnel. The President's Committee on Administrative Management recently recommended that the functions of the council be taken over by the budget bureau.

The council, once one of the most influential of the New Deal agencies but lately of less importance, was established in November, 1933 as a coordinating body for the various New Deal emergency agencies. Its membership included most of the Cabinet members and the heads of the more important emergency organizations. It had an important part in making allotments from emergency work relief funds.

LABOR NOTES

A JURISDICTIONAL strike of an unusual nature has tied up Indianapolis building projects since Sept. 14, when the building trades council there called a general strike of all construction work on jobs employing union carpenters in an effort to compel the carpenters to accept the findings on a jurisdictional dispute of the arbitration board set up by the building trades council. The dispute had its inception a month ago when the carpenters objected to the plasterers doing acoustical work on a Riley Hospital project. Carpenters walked out on that job, and the matter went to the council's arbitration board, a body set up last March. The board awarded the work to the plasterers. The carpenters refused to accept the decision, asserting that the arbitration board had been illegally set up; the present strike is an effort to force the carpenters to accept the decision. Largest of the jobs affected are an addition to the Federal Building, the International Harvester Building, and the Irvington School Building.

Carpenters were involved in another unusual venture, this of an educational nature, in St. Louis, where a plan of compulsory school attendance during working hours for carpenters' apprentices has been worked out jointly by the St. Louis public schools and the carpenters' district council. About 90 apprentices will attend classes at the city vocational school for four hours a week. The union has arranged with employers to have this time taken during working hours. Classes in blueprint reading, mathematics and other technical subjects will be taught by a teacher appointed with the approval of the union, and his salary will be paid jointly by the union and the board of education, an arrangement believed to be without precedent. The teacher will also visit the apprentices at work on their jobs in an effort to coordinate classroom training with practical tasks. The union will supervise disciplinary measures.

The painters' strike in New York City, in effect since August 25, which has taken 15,000 men off construction and alteration jobs in Manhattan and the Bronx was settled Sept. 15. The new agreement provides for a wage of $10.50 for a 7-hour day, as compared with $9 for a day of the same length under the old agreement. Double time will be paid for work on Sundays and legal holidays.

Wage increases were also won at San Francisco in the settlement of a six-week-old strike of plasterers and hod carriers which had affected nearly 1,200 men. The settlement provides for retention of the six-hour day and an increase of hod carriers' wages from $1.25 to $1.60 per hour and of plasterers' wages from $1.50 to $1.75 per hour. The union signed with the Contracting Plasterers Association of San Francisco, a new employer group said to represent a majority of the contractors.

Still going on is the strike called by the International Union of Mine, Mill and Smelter Workers, C.I.O., on the San Jacinto Tunnel of the Colorado River Aqueduct being built by the Metropolitan Water District of Southern California. On Sept. 10, according to district officials, 731 workmen were employed on the tunnel, as compared with 1,190 men before the strike. Officials stated that 337 ft. of tunnel have been excavated since the strike was called August 14.

Attempts have been made on three occasions to interrupt power service to the tunnel. On September 10 a chain was thrown across two high voltage lines, causing a short circuit, and on Sept. 14 and 15 attempts were made to dynamite transmission line towers. Both attempts failed.

In Washington, D. C., installation of air conditioning equipment at the Capitol, the Senate Office Building and the Post Office Building was tied up Sept. 16 when 100 steamfitters affiliated with members of the Steamfitters and Helpers Association, A. F. of L., struck in protest against the employment of laborers to lay some of the pipe for the work. The work protested was being done by the Columbia Foundation Company under sub-contract from the Mechanical Engineering & Construction Company of Baltimore.

Highway laborers in Maryland received a uniform minimum wage scale of 35 cents an hour and a 55-hr. week by a decision of the State Road Commission. The new scale raising minimum salaries from $10 to about $17.50 a week, will go into effect Oct. 1 and will affect about 1,400 laborers. At present wages paid laborers by the commission vary in different road districts.

Employees of the Huntington, W. Va. Water Corp. on Sept. 15, completed formation of an industrial union and applied for a C.I.O. charter. The membership of the union includes meter readers, men employed in the plant, and laborers.

New Colorado Aqueduct Contract Let

Construction of an additional 18 miles of the Colorado River aqueduct distributing system is provided for in a $2,362,000 contract which has been awarded to the J. F. Shea Co. The contract covers construction of a new feeder line connecting to the aqueduct uper feeder in Eagle Rock canyon and extending southwest to Los Angeles city. The contract will bring a total of 322 miles of the 392-mile system under construction.

Construction work was resumed Sept. 11 on the Intake and Gene pumping plants on the aqueduct after being suspended during the summer months because of the intense summer heat. With the coming of cooler weather, open work construction on other sections of the aqueduct will be resumed.

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Tax Exemption End Urged

(*Continued from page 489*)

position will necessitate the overruling of three previous Supreme Court decisions: Panhandle Oil Company v. Knox, which held that state gasoline taxes could not be collected on sales to the U. S. Coast Guard; Indian Motocycle Co. v. United States, which held that federal sales taxes cannot be collected on motorcycles sold to municipalities for police purposes; and Graves v. Texas Co., which held that a state tax on the withdrawal of gasoline from storage could not apply when the fuel was withdrawn for sale to the United States. In all of these there were strong dissenting opinions calling for a revision of the doctrine of implied immunity. The recent case of Brush v. Commissioner of Internal Revenue, which excused the chief engineer of the New York City Water Supply from paying a federal income tax, also carried a plea for revision.

The brief also, in response to another Supreme Court request, presents the federal government's attitude on another question regarding legislative jurisdiction of the federal and state governments on lands owned by the United States for the purpose of erecting dams. Exclusive federal control should be retained, it is argued, over small tracts, but when the amount of land held reaches large proportions the federal government should have the option of waiving exclusive jurisdiction. A case in point is at Grand Coulee, Wash., where several towns have been built on federal property. The local governments of these settlements should, it is argued, be subject to state rather than federal supervision.

WPA Dam Fails At Kansas City

Earth structure 80 ft. high for recreation lake slumps along half its length

On Sunday night Sept. 20 the Wyandotte County Lake earthfill dam near Kansas City, key structure of the largest WPA structure project in Kansas, failed by slumping or dropping of the downstream bank for half the length of the structure. Foundation failure is believed responsible. Planned to impound a recreation lake of 300 acres, the 84-ft. high earthfill, extending 1,550 ft. across the bed and valley of Marshall Creek, was nearing completion when about half of the downstream face extending 800 ft. from the centerline to one abutment slumped as much as 50 ft. The dam is 550 ft. wide at the base and was about 50 ft. wide at the 80-ft. level to which it had been built. It has a puddled clay core and was constructed of clay placed in 8 in. layers and compacted with sheepsfoot rollers.

The foundation failure theory, advanced from several authoritative sources, is based upon past difficulties with the underlying material, upon the appearance of the slumped section, and upon the fact that the clay fill was still in the as-rolled condition, having had no chance of being saturated either by rains or impounded water. The downstream slope had recently been blanketed with riprap.

The foundation material is reported to be a soft blue shale or clay with interspersed sand lenses. Preliminary borings had indicated it to be a hard and impervious shale, and the dam was designed and construction begun on this basis. In May, 1936, however, work was halted when the material was found to be much softer than expected, behaving like a mud rather than a shale, and a sheetpile cutoff was then driven to rock, 50 to 90 ft. below ground surface.

Le Roy Arnold is county Engineer of Wyandotte County. At the time the Park project was begun. Evan Griffith, present director of highways, was WPA director for Kansas and A. B. Nuss, present state highway engineer, was chief engineer. Tom I. Nall, originally in charge of construction, is now state architect. H. L. Reppart is present chief engineer of WPA in Kansas. E. I. Myers of the Clark E. Jacoby Engineering Co., Kansas City, Mo., was consulting engineer. The design is reported to have been approved by both State and Federal authorities.

News Continued on page 526

COMMENT AND DISCUSSION

Readers' opinions on matters that concern the engineer

Zoning Has Some Merit

Sir: I have been a subscriber and reader of *ENR* for over 30 years and have come to rely on every statement being an absolute fact or at least an honest opinion. In other publications I would not have noticed, but I was shocked to read the first sentence in a major article "Zoning is a Failure" (*ENR*, Sept. 9, p. 425), which stated; "For eighteen years I have asked experts to point out one protective feature we would enjoy under zoning, and have received no answer."

This is so evidently untrue to any but a prejudiced mind and not an opinion arrived at by accepted methods of research that I was surprised to see it in your publication. I have lived, and am now city commissioner, in a city that has had a zoning ordinance for the last 15 years. Whether the disadvantages outweigh the advantages may be a question, but whether there are advantages is not even debatable.

Topeka, Kan. LLOYD B. SMITH,
Sept. 11, 1937 Water Commissioner.

[The opinions expressed in the article on zoning were those of the author, Mr. W. H. Henderson.
—EDITOR]

Argument For Zoning

Sir: With regard to Mr. W. L. Henderson's article "Zoning Is A Failure." (*ENR*, Sept 9, p. 425), I should like to make some observations. He raises the point that the use of the police-power is wrong in a land dedicated to freedom. True, the United States is the land of freedom but the rule of the majority prevails and the ideas of the individual have to bend to that rule. If city planning is intrinsically American because it involves the planning of streets, parks, business centers, etc., why is the use of the police-power to protect these plans un-American? If we properly design streets for a business center and then allow the merchants to locate anywhere what is to be gained?

The point that zoning is based on guesswork is not well taken. Why is a present use map made, if it is not for the purpose of taking out the guesswork? The author speaks of a knowledge of land economics, city growth, trends or population shifts. How much time is usually consumed by the real estate interests in actually digging out the facts relative to these parts of the problem? Or do they base their beliefs on what appears to be wishful thinking such as that used by a local editor who urged the building of apartment houses for the young married couples who are now moving away in order to find cheaper quarters, when the actual facts showed the age of persons moving into town had decreased and the average rental was below the amount to be charged by the new buildings. In the same category is the question of the amount of area required for commercial and manufacturing zones. The answer to this question based on facts and not guess work would be a great help to everyone.

The fact that zoning makes no provision for the growth of a city because the zones are not laid out beyond the city limits cannot be said to be a fault of this type of legislation. Rather, this goes back to the principle of establishing city limits. In Massachusetts all of the land has been in some city or town since 1775.

Zoning does not classify citizens by race or color. True. The fifteenth amendment of the Constitution has not been repealed. If the people in an area have invested in real estate should not provision be made to protect them from others coming into and destroying the neighborhood? Municipal zoning as it has been carried on is not paternalism but protectionism. What a person does to destroy himself or his property is his outlook as long as he does not damage his neighbor.

As far as I can see the only way that zoning and cost of new buildings come in contact is in the value of the land. There is being built in a development in Brookline a house planned on the suggestions of the people of Massachusetts owning cooperative bank shares. This house will cost $8,786 complete which breaks down as follows: before the house is started 31.1 per cent; the house itself 39.7 per cent; equipment 17.8 per cent; and finish 11.4 per cent. How zoning could reduce these figures is very questionable. The land cost was $800, at the rate of $0.76 per sq. ft. and this is after all improvements are in.

Winthrop, Mass. FRANK S. FARQUHAR,
September 11, 1937 Chairman,
Town Planning Board

Increased Pay for Engineers

Sir: I have read with great interest your discussions relative to union organization, and have the following to say.

It is impossible for a nation as a whole to increase earnings through union activities because the "pay cannot exceed for a whole class of people in the same profession, what is necessary for an average family in this profession to live on." This statement is called "Lassalle's ironclad wage law."

Another rule, more or less contrary, says that the wage depends upon the supply and demand. These laws are applicable only when a class of people, as a unit with a unit wage set as a goal, is discussed.

Let us study the law of supply and demand and see how it will affect a union wage. Suppose we have 3,000 positions filled with 3,000 engineers with the following pay distribution:

1,000 engineers receive $5,000 per year; 1,000 engineers receive $4,000 per year; 1,000 engineers receive $3,000 per year.

This distribution will be rather stable as long as the supply and demand for engineers is equalized.

Assume now that there will be a surplus of engineers. Then the whole pay scale will be disturbed, because unemployed engineers will try to get work for less money. Gradually the pay will work down for everybody. "The last and least necessary engineer will determine the average pay," because, as Marx says: "The army of unemployed make the pay lower and lower."

Should there again be a shortage of engineers, the situation will reverse. As there is a demand for engineers, the lowest priced soon are going to receive more money, and

soon the average wage will work up for everybody. Even here, "the last and least necessary engineer determines the average pay."

Therefore able engineers will suffer by belonging to an organization trying to fix a wage scale, because this wage scale will depend upon "the last and least necessary engineer."

The present system gives the able engineer an opportunity to keep a high-priced position longer when unemployment increases, and to reach such a position more quickly when a shortage of engineers starts to prevail.

It seems that a very simple solution is to try to get rid of "the last and least necessary engineer" and then everybody for himself.

East Orange, N. J. ODD ALBERT
Sept 14, 1937

Why Not Engineering?

Sir: I note by the Philadelphia *Legal Intelligencer* that on September 13 the President signed a Real Estate License Law for the District of Columbia, effective within 90 days. The news item reads as follows:

"The act follows the general pattern of license legislation already in force in 30 States and 4 Canadian Provinces for the protection of the public against irresponsible or incompetent real estate agents. It provides for examination of applicants for license. Causes for revocation of license (as in the Nebraska, Ohio, Maine, and West Virginia laws) include many of the provisions agreed to be unfair trade practices by the real estate industry in the formulation of its old National Recovery Administration code. These include misrepresentation, acting for one party without the knowledge of all parties, incompetence, using any trade name or insignia of a real estate organization unless entitled to it, guaranteeing future profits from resale of property, placing of signs on property without owner's consent, offering free lots, conducting lotteries or contests as a method of obtaining buyers.

"Real estate licenses issued by the various States are recognized, but non-residents must qualify by paying a fee."

Query: How much more important and why not an Engineering Registration Law for the District of Colmbia?

Phila. Pa., Sept. 16, 1937. SAMUEL I. SACKS, Chairman, Legislative Committee National Soc. Prof. Engs.

Wind Stresses in Tall Buildings

Sir: The work of the British Steel Structures Research Committee, extending over more than six years, (*ENR*, Feb. 18, 1932, p. 259; July 26, 1934, p. 118; Sept. 24, 1936, p. 453) included, without doubt, the most exhaustive study yet made of steel-framed buildings. A noteworthy section in the final report is "The Effect of Wind Loads on Frames with Semi-Rigid Connections" by J. F. Baker and E. Leader Williams. The conventional "cantilever" and "portal" methods of determining wind stresses meet the same fate of non-approval as found elsewhere in articles, papers and textbooks. The method presented, however, is hardly workable in the ordinary designing office. This too is the case with other methods that have been presented. It may be noted that the skyscraper as we have it in America is hardly known in Great Britain.

In "Structural Engineering Problems," a recent book of 155 pages by David A. Molitor, Chapter 7 is entitled "Wind Stresses in Building Frames." The second paragraph begins, "The numerous assumptions necessary to bring this problem within the realm of possible solution are so grossly approximate that any attempted refinement must be excluded on the grounds of imparting fictitious accuracy to something which is nevertheless unknowable." The author attaches little value to many of the refinements of so-called "exact" methods of analysis. Rigidity is emphasized, and in a tall building sufficient rigidity cannot be obtained from the steel frame alone. The help of the "architectural clothing" is necessary and this "cannot be appraised in terms of mathematics."

The author presents an approximate method based on the following assumptions:

1. Columns have points of contraflexure at mid-story heights.
2. Beams have points of contraflexure at mid-spans.
3. Wind loads are divided so that interior columns take equal shears of twice the amount taken by each exterior column. All beam movement of same floor are equal.

It is suggested that the moment at the base of the outside first story column be assumed as the horizontal wind shear on the column multiplied by 0.7 of the story height, instead of 0.5 of the story height as in all the other column sections.

The author maintains that a structure so designed with appropriate details for connections must function in accordance with the disposition of the metal provided in the design. "There is nothing seriously in error with this procedure and it is the only method available." He, however, gives a "more accurate solution for the three bottom stories of a frame."

The foregoing method will at once be recognized as the conventional "portal" method.

In conclusion, it is refreshing to meet a staunch defender of a method that is easily workable. He might well have concluded his chapter with what he considered limitations to the use of the method.

New York, N. Y. ROBINS FLEMING
September 1, 1937

Building Inspection

Sir: I have just read your editorial entitled "Whose Responsibility" in the August 19th issue referring to the recent collapse of tenement houses on Staten Island.

Your editorial certainly has expressed in a simple clear-cut manner a fact that is seldom appreciated by the public. Building departments throughout the country are working under the most niggardly appropriations and with a minimum of personnel, and it is a great wonder that they can continue to give as efficient service as they are at present rendering under the strain and handicap due to lack of transportation and a great variety of inspectional work that the average building department is called upon to perform.

I wish that this editorial could be placed in the hands of all city officials and not left only to those interested in engineering to read.

Washington, D.C. JOHN W., OEHMANN,
Sept. 13, 1937. Inspector of Buildings
District of Columbia

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Editor, F. E. SCHMITT · *Editorial Staff*, V. T. BOUGHTON
N. A. BOWERS, W. G. BOWMAN, W. W. DE BERARD
C. S. HILL, H. W. RICHARDSON, E. J. CLEARY

Editorial Offices at 330 West 42nd Street, New York

SEPTEMBER 23, 1937

ESTIMATES OF A LOSS of 50 per cent of the 3-in. salmon passing through a water wheel in Oregon, based on a test reported in this week's issue, comes as a surprise and a shock. It remains to be seen whether any such percentage of loss will hold for the lower head and larger wheel openings of the Bonneville plant. Pending settlement of that question there is ground for even greater skepticism as to the justification for the large investment in Bonneville fishways and elevators which fishery interest demanded should be made at Bonneville dam for fishways (*ENR* Feb. 25, 1937, p. 316). The expenditures were made in the belief that down-bound fingerlings would pass safely through the water wheel on their way to the sea. Now comes indication that more data are needed concerning the *down-bound* trip. It is rather late now to begin experimenting on the return-trip problem, but after all, the provisions made to enable mature salmon to go upstream are of no avail if their offspring cannot safely get down stream to the sea. Unless some way of getting the fingerlings through the Bonneville power house can be devised the $6,500,000 fish elevators and ladders will be less than fully effective even if they succeed in getting all the fish past the dam on their trip upstream to the spawning grounds.

Getting Action

FOR THIRTY YEARS the cities at the foot of Lake Michigan have been polluting their common water supply. Public opinion time and again has protested. Each time the protest has resulted in a survey to determine more surely the nature and extent of the pollution. Each time sanitary engineers have been progressively more severe in their condemnation of the practice. Chicago long ago heeded the warning and diverted the bulk of its sewage via the Main Drainage Channel down the Illinois valley. Within two or three years it will have completed treatment of this sewage. Until recently the sewage of a few sewers in the Calumet district found its way into the lake. Now the Illinois side is practically free from such pollution but the Indiana cities across the line still offend. Public opinion once again has stirred officials in the latter state, aided perhaps by the recent activity for more drastic federal control of river and harbor waters. Indiana has ordered these cities to cease polluting the lake. Its order is more than the gesture that the former orders were because public opinion is stronger and the demands of Illinois are coming closer to the lawsuit stage as it gets its own skirts clean. The federal threat is probably the strongest incentive toward action, however. Eventually Gary, Hammond, Whiting and East Chicago will build treatment works. It is to be hoped that they will do it before court action is invoked.

A Ranking Conference

DEVELOPMENT of the bituminous road in the country west of the Mississippi has been one of the notable phenomena of modern roadbuilding experience. Faced with large mileages and small income, the highway departments of the plains and of the mountain states have had to focus study on road types that would serve automotive transport well with a thin spread of construction and maintenance funds. They turned to the road- and plant-mix of local aggregates with asphalt, also a native product, first for surfaces and recently for foundation courses. With these materials a remarkable task of roadbuilding is being accomplished and the study of the qualities and combinations of asphalt and local soils is a chief consideration of western road engineers. For three years the Montana Bituminous Conference, whose latest proceedings are reported in this issue, has been the clearing house where research and practices have been prescribed and passed in judgment. Begun almost as a purely regional meeting, the conference has grown to national recognition as a source of current information on bituminous roadbuilding of the secondary types. This growth is one to be proud of; in the three score of formal papers that will be published, roadbuilding will have outstanding literature on base stabilization and surfacing with asphalt and natural soils.

More Than a Program Needed

ONE CANNOT READ the report of the Montana Bituminous paving conference activities without being impressed with the value of such a concerted attack on any current problem. The program was centered around the practical questions relating to a particular type of pavement that is widely used in the West, subjects for the papers were prescribed in order to obtain the widest possible coverage, and before the conference assembled they were read and summarized by selected committees so that no time would be wasted in listening to long-winded authors. In

theory most of our technical society meetings have a like objective but all too frequently they turn out to be quite unproductive because someone fails to recognize that it takes more than a worthwhile program to make a successful meeting.

Back to Normal

CONTINUANCE OF PWA is urged on new grounds by a close observer of employment and construction conditions. His statement on p. 514, following, argues that the PWA system should be continued on a large scale and should be utilized to replace the thinly disguised public charity system operated by WPA. His reasons and conclusions merit general attention because they bear on the all-important question of how the country can get back to normal.

That the WPA is an obstacle rather than a help in the return to normal economic life is widely recognized. Its invasion of the construction industry's field has done great harm; its bad effect on individual and community morale is fully as serious. But its real threat to our future is its tendency to perpetuate an army of relief workers. Anything that gives promise of doing away with this threat has strong claim to consideration.

It must be remembered, of course, that PWA can no longer perform its original service. It was set up in depression days to buy public-works bonds of cities and states, at a time when they could not get money from other sources. By doing so it helped to revive industry and put to work a million men who had been thrown out of their jobs by the failure of the financing mechanism. Today, when municipal bonds have a ready market, PWA can stimulate reemployment only by offering subsidies to those communities unwilling to contribute their share to construction reemployment.

Under this subsidy system, however, we depart farther and farther from normal. Certain present effects are worth reporting. A city which we will call Jonesville has some necessary works to build; plans have been drawn and bonds authorized, and the city is not only amply able to go ahead but is ready to do so. Nevertheless its officials do not feel justified in starting the work so long as they see prospect of obtaining a PWA grant. They are thus keeping some hundreds of craftsmen and laborers out of a job.

The movement back to normal is bound to be slow so long as some communities hope for and others demand federal subsidies for their local improvement works. Has not the time come to abandon the subsidy system in its entirety.

In helping the construction industry the proposals for retaining PWA temporarily that are made in the article on the PWA in this issue would perform a useful service, since full employment and prosperity cannot be attained until the WPA obstacle to construction recovery is removed. But also, construction will not become normal until cities and states return to sound principle and self-reliant action in going forward with their public works, and here PWA grants are an obstacle. That PWA construction is infinitely to be preferred to construction by WPA admits of no question. But if the time has come to wipe out both systems in the national interest, the construction industry should not be satisfied with any half-way measures.

Highway Skylines

THE MODERN HIGHWAY is developing a skyline. Instead of buildings, however, its skyscrapers are the bridges of grade separations which at intervals of a mile or two present inviting gateways to the traveler. How inviting they are, how distinctive and imposing is the skyline depends upon the bridge engineer.

It is a new responsibility. Bridges have challenged the esthetic in engineers since medieval times, but until today a bridge of mediocre or poor appearance incited little comment since it was often beneath the roadway and therefore seldom seen. Bridges carrying crossroads over main trunklines, however, dominate the landscape. Permanent advertisements of the bridge building art, these structures must be attractive and impressive.

Parkway engineers have had a superlative opportunity to demonstrate how these qualities can be properly combined, and they have discharged it in notable manner, largely, however, by recourse to stone facing. Now come the engineers of the Merritt Parkway in Connecticut who boldly strike out to meet the requirements in concrete and steel. Stone facing is shunned if not entirely ignored, and a half hundred bridges result that are as creditable as their stone-faced predecessors.

That each of them will not be universally acclaimed is certain. That some of them have beauty in abundance is equally certain. However, as L. G. Sumner, who writes about them in this issue, remarks, beauty is in the eye of the beholder and the final verdict must be registered by public opinion. In the meantime, the Merritt Parkway can boast one of the most distinctive and imposing skylines of any road in the country. It should give engineers something to talk about during the long winter months. And both its good and bad bridges, as measured by public opinion, will serve to advance the art of bridge building. Its engineers, by designing 50 different bridges to be seen on a 38-mile drive, have stuck out their chins. But by the same token, they can throw out their chests.

PICTURES IN THE NEWS

McLaughlin Aerial Surveys, Inc.

NEW YORK'S WORLD'S FAIR begins to take form. In the center is the Administration Building, first of the fair buildings to be completed. The temporary headquarters and the building where tests are made on building materials and surfacing compounds are in the foreground in what will be a large parking area. Beyond are tracks of the Long Island R.R., and at the right is Grand Central Parkway Extension. In the background are the two artificial lagoons in the recreational area. At the left the Communications Building is under construction and above and to its right work is beginning, in the tree-outlined area, on the theme structure, a 200 ft. sphere flanked by a 700 ft. triangular obelisk. All trees were brought in, some from as far away as Pennsylvania. Horace Harding Boulevard, crossing the fair grounds beyond the theme building, was opened this week.

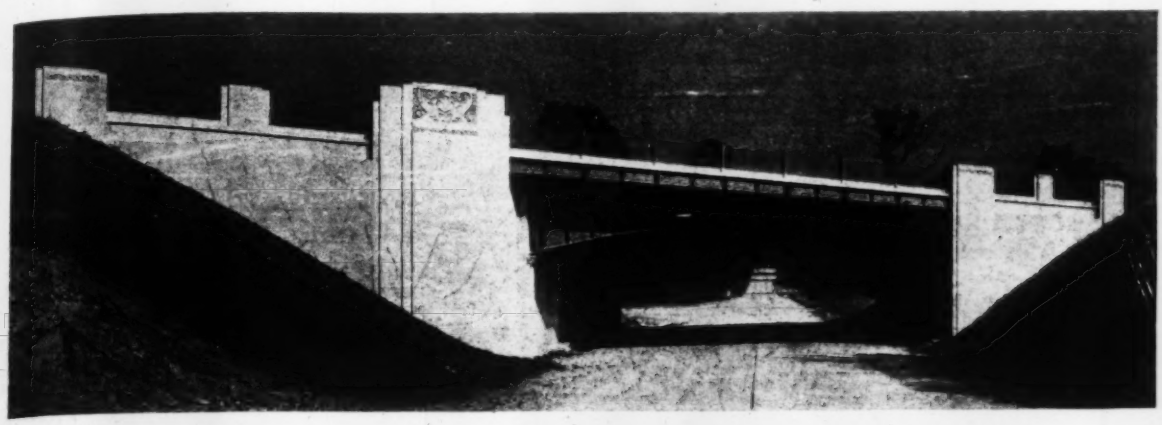


FIG. 1. SCRAFITTO WORK ON PYLONS OF STEEL RIGID FRAME OVER N. STAMFORD AVE.

Bridges on the Merritt Parkway

by L. G. SUMNER

Engineer of Bridges and Structures, Connecticut State Highway Department, Hartford, Conn.

New 38-mile parkway paralleling Boston Post Road in Fairfield County requires 70 bridges, distinguished by special surface treatments and cast ornamentation

THE MERRITT PARKWAY, official designation of Connecticut's latest and most ambitious highway project, now in process of construction in Fairfield County, marks the initial adventure of the state highway department into the field of parkway design and construction. First conceived by the engineers of the department over 10 years ago as a relief route for the Boston Post Road and an additional highway artery between southern New England and the metropolitan area of New York City, the project is fortunate in having reached the stage of actual construction at a time when certain departures from heretofore accepted standards are coming to be regarded as essential for a highway of this type.

Such features as a 300 ft. width of right-of-way acquired by purchase over an entirely new location with no right of access to abutting property owners, a dual-type highway with opposing traffic streams separated by a central grass plot and the general separation of grades at intersecting highways have been accepted as necessities in planning the Merritt Parkway; only a few years ago, these desirable features would have been considered impossible of accomplishment because of the additional expense involved. Fulfillment of the grade separation requirement has been productive of an unusual number of structures in comparison with the customary highway project, and these, because of their prominence, have necessitated a careful study of the esthetic features. In addition they involve a variety of structural types and represent, so far as possible, the latest aspects of parkway bridge design. An article setting forth the general features of the project was published in *Engineering News-Record*, March 14, 1935, p. 386, but a brief review of these and of some of the topographical conditions will aid in making the bridge problem clear.

Parkway plan and financing

Extending New York's Hutchinson River Parkway at the state line, the Merritt Parkway runs easterly over entirely new location, avoiding all centers of population by passing north of Greenwich, Stamford, Norwalk, Bridgeport and other shore communities, and finally swings south to effect a junction with the Boston Post Road at the Housatonic River, its present eastern terminus and the dividing line between Fairfield and New Haven counties. The total length of the project as now established is a little over 38 miles.

The drainage of the country traversed is all toward the south into Long Island Sound, thus contributing to the difficulties of satisfactorily locating a highway whose general direction had to be east and west. There are no large streams, the Norwalk and Saugatuck Rivers being the most important, but the character of the country is such as to favor the establishment of numerous north and south roads to the practical exclusion of anything approaching a system of through east and west communication except in the relatively flat region near the coast. Thus, while the new project offered little of interest or difficulty in the way of stream crossings, it did intersect some 69 cross highways of varying degrees of importance, and 3 railroads. For practically all of these crossings grade separation structures are planned.

From its conception in 1926 by

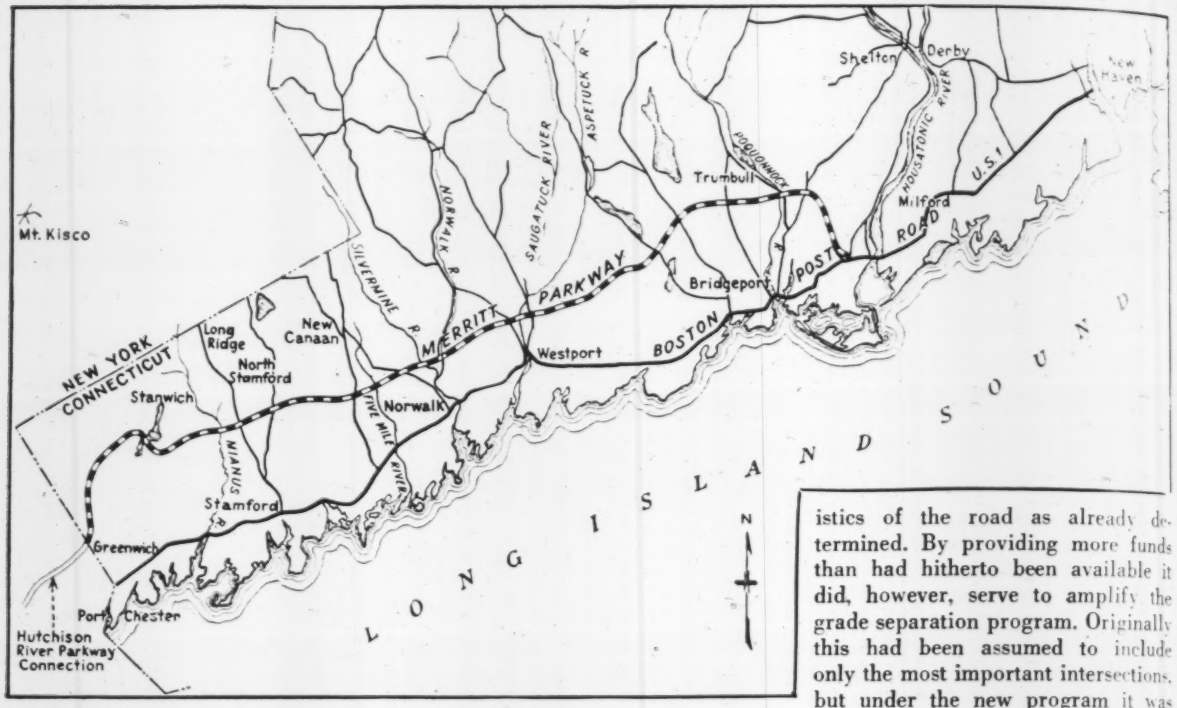


Fig. 2. Route of Merritt Parkway in a 300-ft. right-of-way on new location paralleling the congested Post Road.

the engineers of the Connecticut highway department up to 1931 the project was looked upon simply as a relief route for the Boston Post Road and was generally referred to as the "parallel post road." In the latter year, however, the line having been generally established and funds being available to make a start on the purchase of the right-of-way, the road took its first step toward parkway characteristics by the decision of the highway commissioner to acquire a right-of-way not less than 300 ft. wide for the full length of the project. The money for this purpose, as well as for the first construction work begun in 1934, was allotted from regular highway funds. However, it was apparent that the sums which could thus be allotted would not be sufficient to insure completion of the parkway for a number of years. Therefore, in the spring of 1935 the General Assembly authorized the financing of the remaining construction by means of a $15,000,000 bond issue to be carried by and amortized from highway funds, the amount of such annual charges being about equal to the sums previously allotted for right-of-way purchase and construction. The same act officially designated the road as the Merritt Parkway and prohibited its use by commercial vehicles.

While clarifying the status of the project and speeding up construction, this act did not necessitate any change in the fundamental characteristics of the road as already determined. By providing more funds than had hitherto been available it did, however, serve to amplify the grade separation program. Originally this had been assumed to include only the most important intersections, but under the new program it was extended to provide for practically every crossing highway.

Roadway dimensions

The roadway decided on is of the dual type consisting of two 26-ft. lanes and a center grass plot, the details of which are shown in Fig. 3.

MERRITT PARKWAY BRIDGE COSTS

Bridges Carrying the 60-Ft. Parkway over Intersecting Roads

Name	Skew Angle	Width of Roadway Crossed 30 ft.	45 ft.	50 ft.
Riversville Road	37 deg.	.....	$33,141	
Glenville Water Co.	0 "	.....	.....	$38,591
Taemic Road	20 "	.....	.....	37,010
Long Ridge Road	5 "	.....	31,452	
N. Stamford Ave.	40 "	.....	40,889	
Stamford Ave.	5 "	.....	37,090	
New Canaan Ave.	39 "	.....	35,845	
Comstock Ave.	2 "	$27,074		
Silvermine Ave.	0 "	20,012		
Perry Ave.	0 "	17,227		
Main Ave.*	11 "	.....	70,259	
Chestnut Hill Road	22 "	26,291		
White Plains Road	45 "	.....	47,532	

Bridges Carrying Intersecting Roads over the 60-Ft. Parkway

Name	Skew Angle	Width of Roadway Carried 30 ft.	45 ft.	50 ft.	60 ft.
Round Hill Road	25 deg.	.....	.....	$45,694	
North St.	30 "	.....	.....	45,782	
Stanwich Road	13 "	$30,811			
Rocky Craig Road	0 "	26,400			
Riverbank Road	13 "	25,673			
Wire Mill Road	21 "	28,343			
Newfield Ave.	5 "	25,777			
Ponus St.	14 "	24,167			
Lapham Ave.	0 "	23,809			
Darien Road	24 "		$32,935		
White Oak Shade	25 "	30,563			
Weed Ave.	17 "	25,976			
Sport Hill Road	20 "	33,285			
N. Main St.	13 "	.....	.....	.....	$33,900

*One structure for each lane of the parkway; roadway width of each, 30 ft. 10 in.

At bridges carrying the parkway and for sections of the parkway passing under grade separation structures, it has generally been the practice to provide a clear roadway width of 60 ft. with opposing lanes separated by a low curb 16 in. wide which is simply a continuation and a merging of the two curbs bounding the center grass plot on usual sections. The transition from the regular parkway section to the bridge section is made by long-radius reverse curves which gradually reduce the width of the grass plot and draw the lanes in to the bridge sections (Fig. 3). Although this is the usual practice, no definite rule is enforced, and the procedure has been varied for some locations by providing a separate structure for each parkway lane, while one railroad is carried over the parkway on a two span structure with a pier in the central grass plot, the parkway section being carried through without change.

For structures over the parkway a minimum vertical clearance of 14 ft. is maintained for a horizontal width of 40 ft. normal to the parkway while at the curb the vertical clearance is reduced to 11 ft. For crossroads carried over the parkway, the width of roadway varies with the importance of the road carried, but a minimum width of 30 ft. has been established with a usual width of 45 ft. where the intersecting road is a state trunk line. Vertical clearances for bridges carrying the parkway over intersection roads have been held to a minimum of 14 ft. for the full width of the roadway, which again is varied according to the importance of the road.

Design fundamentals

The design live load for all structures is the familiar H-20 as used for all state highway structures. While the regular use of the parkway is restricted to pleasure vehicles, the necessities of maintenance and snow removal will require the occasional passage of heavy units. Also, unforeseen emergencies or change of policy may later require the road to carry commercial traffic so that the slight economies which might be effected by a reduction in live load requirements were felt to be unjustified.

Foundation conditions encountered have been excellent as a rule, ledge rock or other suitable material being almost always encountered at convenient depths, and in only two cases, so far, has it been necessary to resort to piles. This has considerably simplified the design problems by eliminating the need for extended foundation studies and has allowed wide freedom of choice in the selection of type for the various structures.

Bridges for a parkway project present a somewhat different aspect from the usual run of bridges in that the appearance of the finished work is considered of primary importance so that, while sound principles of design and economics should not be abandoned, a certain amount of additional expense over and above the cost of a strictly utilitarian structure is justified. One reason for this is that the route usually passes through country of some natural beauty which should not be marred by the more unfortunate works of man. Also, the further landscaping of the right-of-way and the underlying conception of the project as a thing of beauty, combine to create in the minds of the designer and the user a desire for a pleasing and harmonious appearance in all phases of the work.

It has become rather axiomatic to consider that parkway structures should be of the arch or rigid frame type and should be faced with masonry because of the pleasing effect obtained and the ease with which such construction may be fitted into the usual parkway setting. With the selection of this type there can be no reasonable quarrel as it gives, under most conditions, a maximum of economy while offering possibilities of considerable beauty in the careful working out of the design.

Unfaced structures chosen

At the start of work on the Merritt Parkway, however, funds were strictly limited, and it was necessary to consider every economy consistent with the general ends to be attained. It was estimated that masonry facing would add from 10 to 15 per cent to

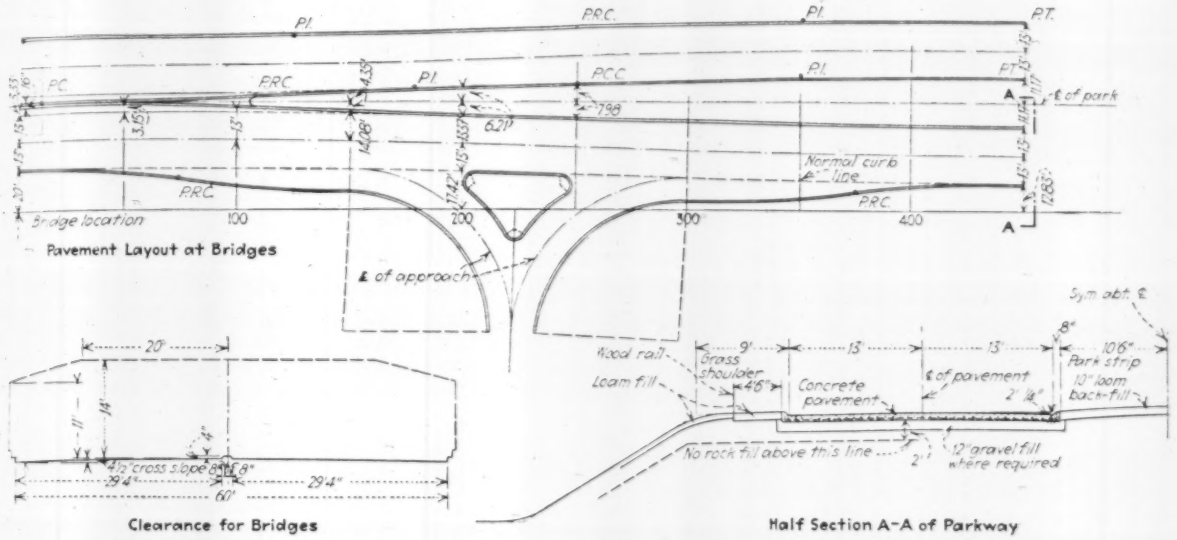


Fig. 3. Pavement and bridge dimensions and details on the Merritt Parkway reflect modern requirements for safety.

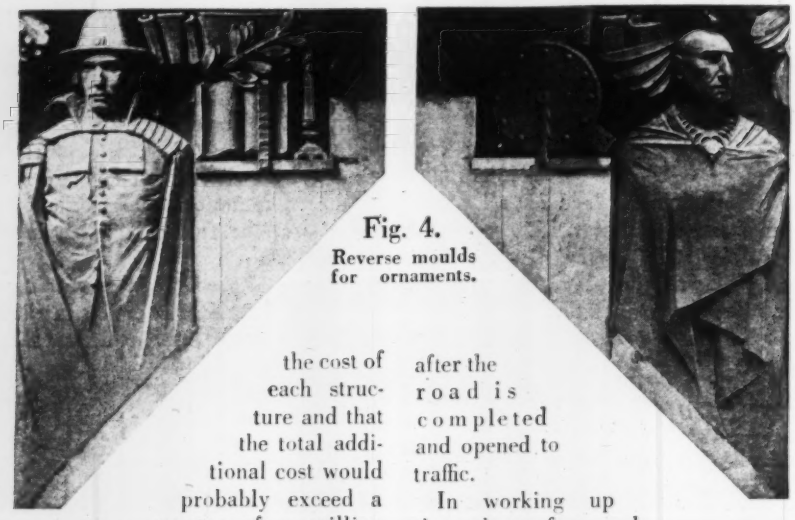


Fig. 4. Reverse moulds for ornaments.

the cost of each structure and that the total additional cost would probably exceed a quarter of a million dollars. This sum was considered sufficiently important to warrant further study as to the possibilities of producing satisfactory designs by the use of other materials. Also there was a possibly egotistical feeling that masonry did not offer the only possible solution, and that equally pleasing results could be obtained by the use of other media.

Removing the masonry facing left exposed the fundamental supporting materials, the steel and concrete, of which the structure is really made, and it became the problem to treat these materials so as to produce structures of pleasing appearance. A masonry-faced structure makes its principal appeal by reason of the blending but varied character of the stone surfaces and the massing and proportioning of the whole design. Small details, projections and ornaments are generally unnecessary and often detract from the appearance. On the other hand, a structure in concrete must depend for its effects upon contrasts, the casting of shadows, and well chosen details and ornaments in addition to a careful balancing of the essential features, all of which requires considerable study and good judgment on the part of the designer.

It was with a full knowledge of the difficulties involved that the decision was finally made to provide a series of structures, essentially in concrete, carefully studied to provide a pleasing and harmonious appearance in keeping with the general character of the project. How well this has been accomplished must await the verdict of public opinion after the road is completed and opened to traffic.

In working up the plans for each structure, as soon as the essentials of line, grade and required structural dimensions have been determined, several different ideas for surface treatment are considered. These are presented in rough outline and those considered most favorably are then worked out in more detail, usually including a perspective view to forecast more accurately the finished appearance. In many cases, the customary use of mouldings, panelling etc., has been extended by the inclusion of designs calling for the use of precast concrete ornaments, details poured by means of reversed plaster moulds and two-color "sgraffitto" work. Among such details used are the state seal, sunburst medallions and figures of Indians and early Colonial settlers.

Precast ornaments may be made to an infinite number of patterns depending only upon the ingenuity of the designer; and when made by a competent manufacturer they are very pleasing in appearance. Reverse plaster moulds have been employed in some instances to permit of designs involving details too elaborate for construction by means of the usual type of form work. Their use involves a certain amount of care and experience on the part of the contractor especially in chipping away the mould after the concrete has set but, given competent workmen and a cooperative contractor, no great difficulty has been experienced.

Sgraffitto work consists of preparing the precast blocks in two courses, poured monolithically and of contrasting colors. The outer, or exposed surface is made to harmonize with adjoining surfaces of poured concrete and is relatively thin, say ½ to ¾ inch. The undercourse is made appreciably darker in color. The design is drawn on the exposed surface of the block and the necessary portions of the top surface are then carefully chipped away exposing the darker undercourse and bringing out the design in good contrast. All this, of course, is done at the plant of the manufacturer who must be duly qualified and experienced in such work to insure good workmanship and a satisfactory reproduction of the indicated details.

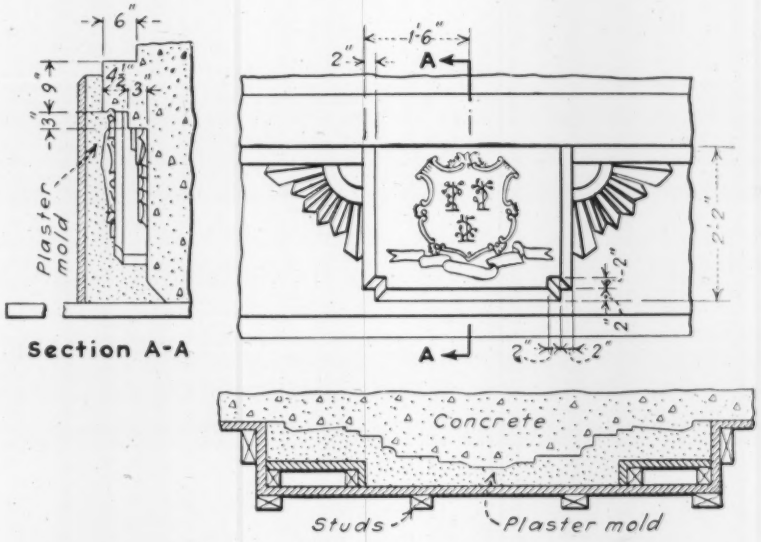


Fig. 5. Form work for precast ornament involving state coat of arms.

Although all of the structures have, of necessity, certain features in common, every effort has been made to vary the external appearances and details and to avoid any semblance of standardization. The sites are studied and an attempt is made to fit dimensions and details to the setting in which they will be placed. While not adopted for a majority of the bridges, masonry facing has not been entirely ignored as a solution for locations where the natural setting is particularly favorable to this type and, thus far, three such structures have been placed under contract.

Progress to date

The progress of construction work has been satisfactory, although it is not claimed that any records have been established. Except for one section north of Bridgeport and a bridge in Fairfield, the work has progressed from the New York state line at Greenwich easterly, and grading and structures have been completed or placed under contract to a point near the Norwalk-Westport town line, a distance of about 20 miles. The section near Bridgeport is about 3 miles long so that approximately 60 per cent of the length of the parkway is graded and provided with structures. The first paving contract, 3½ miles, starting at the Greenwich end, was awarded in May, and it is the present goal to open the road as far as Norwalk to traffic by late Fall.

Of the total number of bridges required, there have been completed or put under contract 28 highway grade separations, 15 stream crossings and 3 railroad grade separations. There remain about 40 additional highway grade separations, the exact number being uncertain because detailed studies and decisions regarding all intersecting roads have not yet been completed; also, there are 3 additional stream crossings including one over the Saugatuck River in Westport—the most important and difficult bridge job on the parkway.

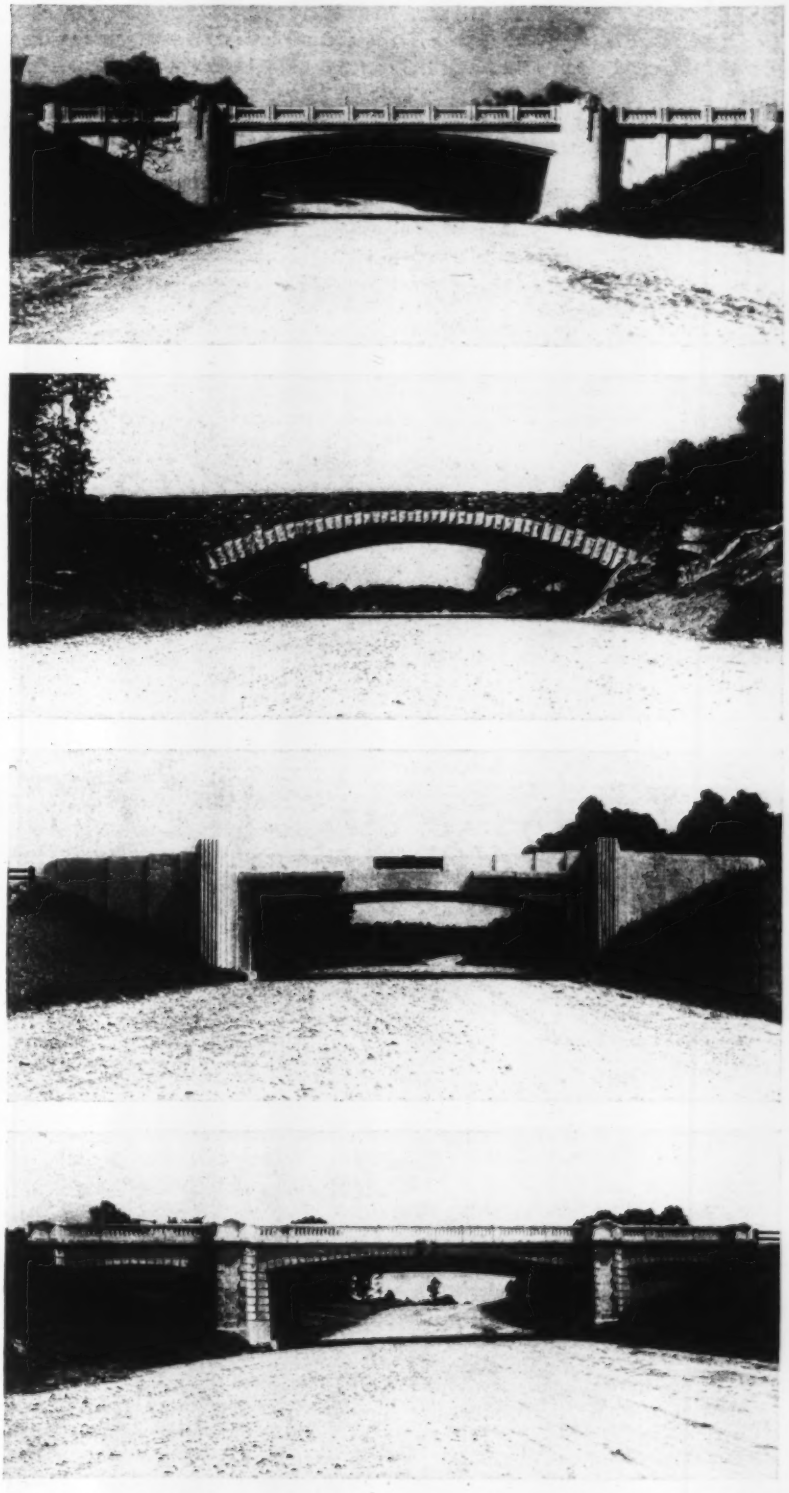


Fig. 6. Typical bridges that carry intersecting roads over the parkway. Top to bottom: Stanwich Road, Greenwich; Rocky Craig Road, Stamford; Newfield Ave., Stamford; Ponas St., New Canaan.

Costs

No discussion of a project is complete without a word about costs, although it is somewhat difficult to present such data in a useful form unless accompanied by considerable detail. Also local conditions and practices have to be taken into consideration. To give an idea of the conditions and prices prevailing in the construction of the Merritt Parkway, the following represent the average unit prices obtained on 27 highway grade separation structures of various types:

Unclassified excavation...	$1.14 per cu. yd.
Concrete (1-2-4)	12.98 per cu. yd.
Reinforcing steel	0.039 per lb.
Structural steel (beams) .	0.027 per lb.
Structural steel (frames) .	0.060 per lb.

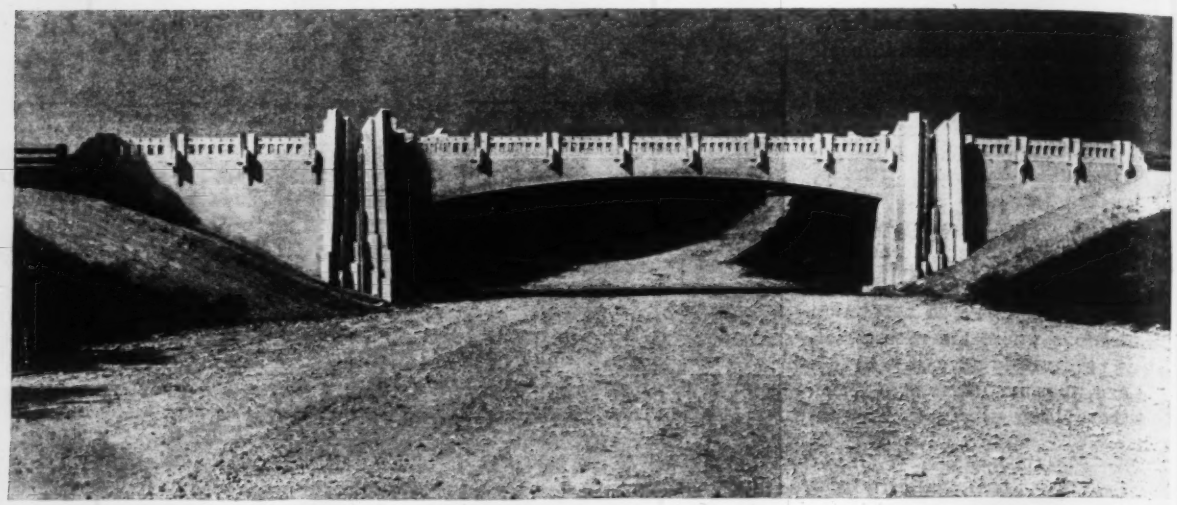


Fig. 7. Rigid frame of 70 ft. span that carries Riverbank Road, Stamford over the Merritt Parkway.

Random masonry	$27.80 per cu. yd.
Dimension masonry	76.70 per cu. yd.
Bridge railing	4.88 per lin. ft.
Portland cement	2.41 per bbl.

These prices cover contracts awarded over a period from March, 1934 to date and are not materially different from those at which recent work has been awarded.

The costs of some of the grade separation structures are given in the accompanying tabulation. The total contract price for all these structures, many of which are still in process of construction, is about $951,000. Special ornamentation has been employed to a varied extent. Some structures have none at all, while the most costly yet employed amounted to $1,521 on a structure costing $40,889. The total amount for all such ornamentation work to date is a little less than $8,000 or not quite 1 per cent of the total cost of the bridge structures.

The planning and construction of such a large number of structures of related character but differing in detail and appearance has presented many problems of great interest to those engaged in their solution. Designs have been studied, discussed and changed and new materials and methods tried in order to produce the effect desired. However, realizing that beauty is in the eye of the beholder, the verdict of the general public is awaited with considerable interest and some anxiety when the first section of the parkway is open to traffic.

All of the work of design, planning and supervision of construction has been done by the regular organization of the Connecticut highway department, augmented as necessary to care for these projects, which are being carried on in addition to the regular highway program. It has been found advisable to establish a separate unit of the bridge design section to handle parkway projects exclusively. This has made for a certain continuity of thought and familiarity with details considered essential to a proper handling of the special features involved in the planning of these structures.

• • •

City Planning Held Vital To Success of New Housing Program

CITY HALLS in many American cities soon will be scanning provisions of the national housing program to determine what federal assistance they can get, and what the legislative guide lines are for pointing up a local housing project. And one vital phase of the housing program which thus far has challenged little attention is its city planning aspect.

Cities which have city plan commissions, or which have power under their state laws to establish such bodies, have a valuable tool immediately at hand to assist in launching housing programs, the American Society of Planning Officials points out. These planning commissions, indeed, are considered absolutely indispensable to properly conceived housing projects by some administrators.

The local housing authorities which would be set up under the federal housing program must proceed in scientific fashion to lay down their plans for financing the program, for land acquisition, site-planning, layout and design of the dwelling units, supervision of construction, rent schedules, general operation and management. Certain facts must be known if each locally-independent housing authority hopes to achieve permanent success for its housing project. The community's known social, economic and physical factors have direct bearing upon housing project success.

For instance, the local authority should determine the extent of the housing need among the group to be re-housed; and the availability of land, large enough in area and low enough in price for low-cost housing accommodations. Sites for housing projects should be studied in their relation to employment sources, schools, shops, and transportation facilities.

The logical place to look for such data is the city plan commission. Planners recommend that the city examine its plan commission to see whether it is properly staffed and with sufficient funds to handle these added duties.

Test of Precast Concrete Floor Units

by Addison F. Holmes and Herman G. Protze, Jr.

Associate Professor of Applied Mechanics and Instructor in Materials Testing, Massachusetts Institute of Technology, Cambridge, Mass.

Investigation at M. I. T. produces new data on shear resistance, strength and absorption of blocks used in so-called unit-and-joist floor system

In considering the use of a "unit-and-joist" floor system for a school building in Boston, city engineers raised the question as to what effect variance in the type of concrete used in the precast units might have upon the completed floor. The series of tests reported here were undertaken to provide data that might permit a satisfactory answer.

Unit-and-joist floors consist of groups of two precast concrete units placed with the open sides together and spaced to allow for 4-in. reinforced concrete ribs to run parallel to the girders in both directions as shown in Fig. 1. In this construction the net area of the units is considered as a structural part of the slab and beams on the assumption that there is adequate bonding with the adjacent concrete.

The precast units usually embody the use of light-weight aggregates in a rather lean, porous mix, which may have been either tamped or pressed into molds, and probably subsequently steam cured. Units are usually thin-shelled and may have several or no internal webs. Of 8 x 8 x 16-in. nominal size or smaller, the units are open on one face only; to produce the "tin-pan" effect, two units are usually placed on their sides "open to open."

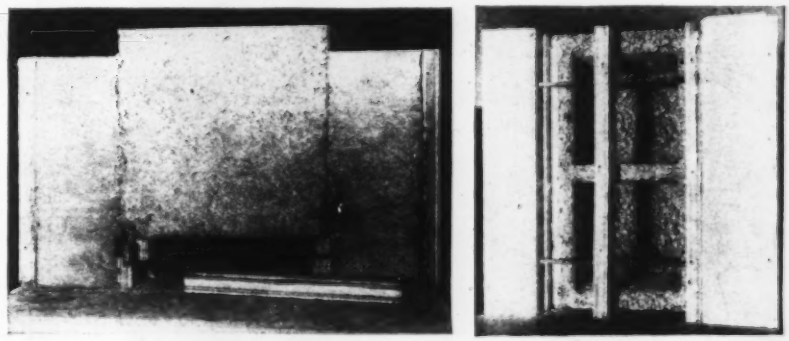
In certain sections of the country the units have been made from slag concrete while in other localities cinder concrete units have been employed. In the investigation it was decided to use three types of 8x8x16-in. floor units which were designated as follows: *S*, a patented unit made from slag concrete; *O*, a cinder concrete unit made with normal portland cement; and *H*, a cinder concrete unit made with high-early-strength portland cement. The *S* type of units were compressed during fabrication, following the particular manufacturer's usual procedure. The *O* and *H* units were of the tamped variety.

For the determination of the modulus of elasticity, each manufacturer was required to fabricate six 6 x 12-in. cylindrical specimens which were presumably of the same mix as the floor units, and were cured and aged in the manufacturer's standard manner.

Six specimens of each type were tested for absorption. The samples were oven dried at approximately 105 deg. C. to constant weight. After cooling and weighing, they were submerged in running water at 20 deg. C. for various periods. Immediately upon removal, they were surface-dried, weighed and then resubmerged. Per cent absorption is expressed in terms of original oven dry weight (Fig. 2).

For the compression test, each specimen was measured with calipers to determine the actual net and gross areas and then was faced with neat high-early-strength cement, the closed side first and the open side 20 hr. later. The specimens were tested 7 days after the initial capping, using a testing head speed of 0.05 in. per minute.

The cylinder specimens used for the modulus of elasticity determinations were measured and weighed to determine the bulk specific gravity



From Republic Fireproofing Co.

Fig. 1. Typical unit-and-joist floor system showing both one- and two-way slab types.

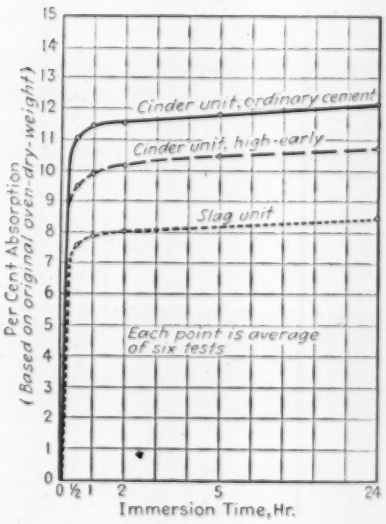


Fig. 2. Absorption of concrete floor units made from three different kinds of concrete.

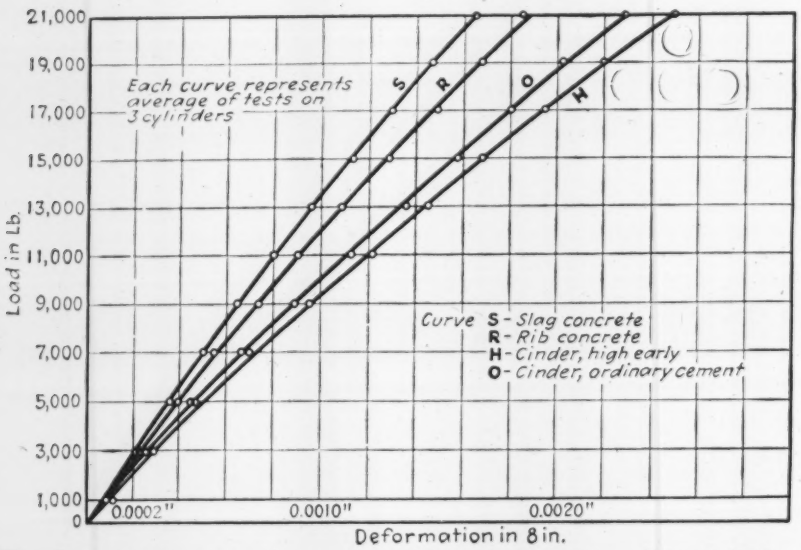


Fig. 3. Load-deformation diagram for 6x12 in. cylinders of four different kinds of concrete.

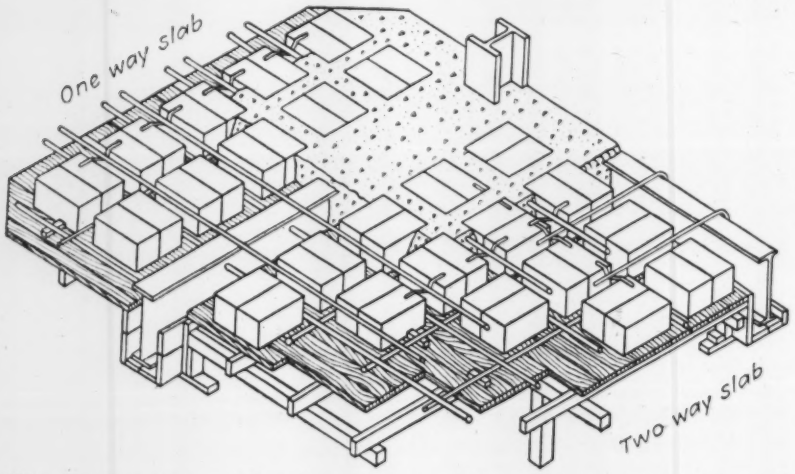


Fig. 4. Typical shear failure in specimen consisting of pre-cast units with poured concrete ribs either side. End view at left and bottom view at right.

at time of test. Tests for modulus of elasticity and compressive strength were made at the age of 28 days. Berry strain gages reading directly to 0.0001 in. were employed in taking the strain readings. To prevent creep and other difficulties, a slow continuous loading speed of the testing head of approximately 0.001 in. per min. was employed. The secant modulus of elasticity (between zero and 21,000 lb. or zero and 743 lb. per sq. in.) was calculated in each case using the formula Sec.

$$\text{Mod.} = \frac{21{,}000 \times 8}{28.3 \text{ (def. at } 21{,}000)}$$

(see Fig. 3 for load-deformation diagrams). The specimens were then tested to fracture.

Thirty-six test specimens were fabricated for use in determining the shearing strength or bond between the floor-unit faces and ordinary concrete (Fig. 4). These specimens, and twelve 6 x 12-in. companion cylinders of ordinary concrete which were cast at the same time as the ribs, were moist cured for 4 days, and then remained in the forms in the laboratory until time for testing (7 and 28 days after pouring of rib concrete). Rib concrete was ready-mixed, nominal 1-2-4 dry and loose volumes and mixed to a 6-in. slump. Sand was well graded, composed of granite and silica; gravel was 1 in. maximum, granite and quartzite. The loading tests were made at a speed of the testing head of 0.1 in. per minute.

The following table gives a summary of the test results:

SUMMARIES OF RESULTS OF TESTS

Compressive Strength of Units (Lb. per sq. in.)

	"S" units	"H" units	"O" units
On net area	2,570	2,570	2,640
On gross area	1,060	1,160	1,290

Tests of 6 x 12 in. Cylinders (28 days)

	"S" concrete	"H" concrete	"O" concrete	Rib concrete
Bulk density (lb. per cu.ft.)	137	113	113	133
Compressive strength (lb. per sq. in.)	4,120	5,550	5,430	3,590
Modulus of elasticity (lb. per sq. in.)	3,600,000	2,380,000	2,600,000	3,220,000

Av. strength at 7 days 2,720 lb. per sq. in.

Shearing Strength or Bond (Lbs. per sq. in. net shear area)

	"S" units	"H" units	"O" units
7 days	300	411	381
28 days	539	572	582

A study of the data and results (all of which are not given in the article for lack of space) indicates:

1. The floor units made from slag concrete weighed approximately 12 per cent more than the cinder concrete units, despite the extra center rib contained in the latter.

2. None of the units under consideration showed the presence of excessive harmful chemicals.

3. At 24 hr. the cinder-high-early and cinder-ordinary units had absorptions 27 and 44 per cent greater, respectively, than the floor units made from slag concrete. A significant conclusion reached during this test was that the relative ultimate absorption of blocks may be predicted after 1 hr. of soaking.

4. Cinder units in general proved to be 10 per cent stronger than the slag concrete units. The additional (and helpful) center rib in the former may account for a part of this increased strength. In 6 x 12-in. cylinders cinder concrete was 33 per cent stronger than slag concrete.

5. The slag concrete has a modulus of elasticity about 45 per cent greater than that of the cinder concrete. While this means less deformation per unit of stress in the former case, it is even more significant that the slag concrete has very nearly the same modulus of elasticity as the 1-2-4 rib concrete to which it is bonded in use. This should make for effective unit action.

6. There is little difference between the ultimate shearing strength or bond between the ordinary concrete and the various units at 7 days. At 28 days (age of rib concrete) the bond with the cinder concrete averaged about 7 per cent greater than that with the slag concrete.

Welding for New York Buildings

by GILBERT D. FISH

Consulting Engineer, New York, and Chairman, Committee on Building Codes, American Welding Society.

Approval of structural welding by New York City building code finds the art eleven years old and its advantages and limitations widely recognized

THE NEW BUILDING CODE of New York City, to take effect next January first, makes full provision for welding structural steel. Although several hundred other American cities and towns have given legal recognition to welding during the eleven years since it was first used for heavy building construction, the prominence of New York as a construction field and engineering center makes the city's action especially significant. In view of the fact that many owners have wanted to use welding in New York and would have done so if permitted, it appears almost certain that building plans contemplating welded framework will be filed under the new code before long.

One or more of three reasons is usually behind a decision to weld a structure. The most familiar one is the silence of the process in contrast with riveting. Another motive is a desire to gain experience in or to promote the use of welding. The third reason, which will probably be the principal one in the long run, is the economy of well planned welded construction.

The noise abatement motive

The public recognizes the desirability of avoiding riveting noise in adding wings, stories or separate buildings to hospitals, schools and other institutions. Not so obvious, yet easy to demonstrate, is the commercial importance of quiet construction in business areas. Hotels have been known to lose half their patrons during erection of nearby buildings. Executives of large companies have expressed the opinion that the efficiency of office workers is seriously impaired by the peculiarly disturbing noise of riveting. The management of a Wall Street bank mailed apologies to nearby firms before erecting a structure for its own occupancy.

Interest in the new method

The second motive cited as influencing decisions in favor of welding is not general or permanent but has played an important part in the development of structural welding. Interest in the welding method, apart from advantages in the particular project considered, may spring from business connections with the welding industry or from professional zeal in acquiring experience.

A number of large electrical manufacturers and power companies made opportunities, in the early years of welded construction, to apply welding in the construction of large buildings for their own use. The first case of that kind was a large five-story factory at the Sharon (Pa.) plant of the Westinghouse Electric & Manufacturing Co., requiring 800 tons of steel, constructed in 1926–1927. From time to time, owners or their engineers have been influenced toward welding by a wish to employ the most modern method in steel construction. It is likely, now that the ban on welding New York City buildings is about to be lifted, that many engineers and architects may wish to gain familiarity with it in anticipation of requirements.

Economy

In the eleven years during which welding has been used for buildings of considerable size, economy has played a more prominent part in the growth of the practice than is commonly believed. The issue is controversial and is still confused by instances in which alternate bidding on riveting and welding results in contracts based on riveting. However, welding usually wins in competition if the designing for welded construction is skillful and if some of the bidders are experienced in estimating welded work.

Merely asking for alternate bids on a single steel design intended to apply to either form of construction generally fails to take account of weight-saving changes which could be made in the design to suit the possibilities of welding. However, even where lack of time or the general layout prevents saving steel in the design of main members, welded connections save a major fraction of the detail material required for riveting. In jobs handled by engineers really experienced in structural welding, shop fabrication and field work are both reduced in comparison with the work required for riveted work.

The writer has been concerned with about one hundred welded structures of considerable size, mostly buildings, and has given a great deal of study to cost comparisons between welded and riveted construction. In a large proportion of cases, open bidding on welding versus riveting was arranged. This experience, including shop and field supervision of many of the projects, has convinced the writer that welding is basically more economical than riveting, saving both material and time. The occasional instances in which riveting brings the lowest bids in competition will probably cease to occur when steel contractors at large know how to estimate and handle welded work.

Welding affords advantages in numerous special applications which do not occur in all buildings but which are important frequently enough to justify mention. One such feature is that changes in design and correction of errors can be effected

during erection with great ease at small expense, without sending members back to the shop and without drilling holes in the field.

Special Advantages

In alterations and additions, reinforcement of existing members and attachment of new members to old columns or girders can be accomplished without exact measurements, without drilling holes and with a minimum of cutting into walls and fireproofing.

For especially strong and rigid wind or earthquake bracing, welding provides the only means of making girder-to-column connections develop the full bending resistance of the members unweakened by holes. Again, welded wind bracing is more compact and, for a given depth, far more rigid than any possible riveted bracing; the compactness may save awkward projections beyond normal faces of fireproofing, and the extra stiffness may make a tall building more comfortable in gales.

A property of welding, which is sometimes effective in reducing the total cost of steel and which may save enough headroom to eliminate a course of brick in each story, is that it makes continuous beam design practicable. As continuous beams deflect far less than simply-supported ones, this feature should be remembered when vibrating machinery is to be carried and also when the necessity for shallow beams threatens plaster cracks.

Disadvantages of welding

Planning a welded building seems to require somewhat more engineering work than that required for riveted construction, apparently because the practice is relatively new and demands preliminary thinking and sketching and because the unlimited variety of possible connection forms has been unfavorable to standardization. Another cause of extra work is designing to take advantage of opportunities to save steel in the main members such as continuous-beam construction, to use built-up sections in place of rolled shapes or to devise a new style of truss assembly. Again, it is beyond dispute that supervision of welding fabrication and erection requires time-consuming precautions and systematic inspection, exceeding the amount of attention customarily given to riveted work.

Aside from extra engineering work, the practice of structural welding over a period of eleven years has not brought to light any general disadvantage in comparison with riveted construction. Shop superintendents and erection foremen, when handling welded work for the first time, often complain about various detail difficulties, but nothing comes up which cannot be overcome by a little experience.

Welded buildings have been in use long enough, that the permanence of such construction is not in doubt. Close observation of erection has made it clear that no delays or interference with other trades need occur due to the use of welding. The normal hazards of steel erection are in no way increased by substituting welding for riveting, as shown by the marked absence of accidents and the favorable insurance rates.

Safety of welded connections

The safety record of welded buildings, both in this country and abroad, has been excellent; so far as the writer knows, there have been no failures at all. In view of the hundreds of structures, some of them containing thousands of tons of steel apiece, and the wide geographical distribution of the practice, the absence of failures in eleven years of active growth proves the controllable nature of welding as applied to buildings. It does not follow, of course, that welded construction would be safe under careless supervision.

Safety factors in design of welds are somewhat higher than those used for structural steel members and for riveted connections. The extensive tests, made by the structural steel welding committee of the American Bureau of Welding and reported by them in 1931, showed that the mean ultimate strength values were very high in relation to design stresses and that the dispersion among the values was such that "welders who have attained the qualification results . . . may be expected in commercial practice to produce welds of a strength within 12 per cent of a general average."

Three lines of defense against defective welds are generally used in combination: (1) Welding operators are examined as to experience and are required to pass quantitative strength tests; (2) an inspector watches the performance of each operator from time to time while work is in progress; (3) an inspector examines all completed welds not only for quality as indicated by appearance but also for agreement with drawings as to sizes, lengths and locations.

Remarks are often heard that inspection methods used in welding supervision are not positive and cannot be relied upon. The fact of the matter is that the recognized methods mentioned above have been abundantly proved to be effective in controlling safety. There is no disagreement on this point among engineers experienced in welding work.

Comments about the personal equation in welding, frequently made as a sweeping criticism of the process, miss the important point that wide variations occur only between operators who are qualified and those who are not. There is little variation among qualified welders and still less variation in the strength of welds made by one welder at different times.

While convinced, from ample evidence spread over a long period, that welding is controllable and dependable, the writer believes that the process demands closer supervision than is ordinarily given to other construction methods. It is especially important that inspection be extended systematically to *all* connections. An inspector must remember that a single weld of deficient size or wrong location may constitute a hazard, and that a missing weld has no strength at all.

Precautions in design

There are not many pitfalls in the designing of welded frame structures which are likely to trap an experienced structural steel designer when he takes up welding for the first time. He may make a poor showing in economy, due to lack of welding experience, but he will probably provide safety.

The literature of structural welding gives the rules of designs for welds and illustrates innumerable connection details, but the designer will

do well to guard against high secondary stresses in inflexible connections, about which it has been found difficult to formulate satisfactory general rules. A common slip of newcomers is to indicate welds in inaccessible places. Another very natural mistake is to call for connection details which would interfere with each other.

Good judgment, combined with a fair knowledge of steel erection, is needed in planning the number and arrangement of erection bolts. No satisfactory substitute for erection bolting has been developed, and nothing causes more serious delays than unsuitable provisions for such bolting.

Contractors' experience

A partial list of buildings and structures similar to buildings, thus far built in the United States with all or nearly all connections shop welded and/or field welded, comprises well over 200 structures. Of course, welding has been used as an auxiliary process in many hundreds, probably thousands, of buildings, in which most of the connections were riveted or bolted. The largest all-welded structures have run to about 2000 tons of steel, while others which were mostly welded have reached about 4000 tons. There is a considerable number of all-welded or completely field-welded buildings from 11 to 19 stories.

Most of these structures have been fabricated by shops regularly engaged in building construction. Many of them, but probably not a majority, have been erected and field welded by the fabricators. In cases where field work has been sublet by the fabricators or separately awarded by the owners or general contractors, it has been fairly common practice to employ welding contractors (other than the steel erectors) for field welding.

In some parts of this country, notably the Northeast, it is easy to obtain bids on welded construction, but whether or not such bids show a cost-saving in comparison with riveting depends considerably on whether the exact location and size of job make it attractive to local steel concerns inexperienced in welded work.

Except for a limited number of steel contractors who have recognized the growing importance of welding, the attitude of the steel fabricators toward the practice of all-welded construction has been to wait for customer demand rather than to take the initiative in suggesting it. There is noticeable a very pronounced anxiety, especially among large companies with elaborately equipped plants, about the tendency of welding to reduce the utility of machinery intended for riveted structures. They seem to hope, by continuing the older form of construction, except where customers make a point of welding, to keep the growth of welding very gradual.

There is no doubt at all that if welding had been offered by the steel industry to the public in the same way as new developments in motor cars have been presented by automobile makers the construction industry would long since have been thoroughly familiar with it. When the leading electrical manufacturers decided, about ten years ago, to change large machine frames and bedplates from cast iron and riveted steel to welded steel, a few customers objected, but in a couple of years the old-style construction was no longer on the market to any considerable extent.

It appears likely that customer demand will continue to be the principal force behind the growth of welded construction, at least until a large proportion of fabricators find that welding saves an appreciable percentage of cost; at that stage, natural economic forces may be expected to accelerate the change.

It is difficult for the writer, after making a specialty of welded structures for a long time, to consider objectively the possibility that welding may not be destined to replace riveting generally. It is a fact that many who have had experience with structural welding think of it as a supplemental process, to be used for many applications where it has special advantages but not to replace riveting for most purposes. This controversial question will never be settled by debate. Fortunately, the engineer or owner who wishes to employ the most suitable means for constructing a particular job can make up his mind without reference to whether welding is going to displace riveting generally. Even those, who do not expect welding to be the principal means of connecting steel admit that it has become a recognized part of structural shop practice and steel erection.

Welding in the New York code

Except for administrative provisions, the clauses in the New York building code relating to welding have been taken from the 1930 edition of the American Welding Society's Code for Fusion Welding and Gas Cutting in Building Construction and from the only edition of the society's Code for Resistance Welding in Building Construction. The 1934 edition of the fusion welding code would have been preferable, but there were obstacles in the way of changing the draft of the proposed city code to take account of the revisions in welding standards. The discrepancies are not numerous or very important and are not likely to interfere with progress.

The administrative clauses include the following provisions:

(1) "The commencement of any structural welding work is forbidden until an application for a permit to perform such work is filed with and approved by the Superintendent. The Superintendent shall be notified in writing at least 48 hours prior to the date when the structural welding work is to commence."

It is not clear whether this requirement is intended to apply to shop work as well as field work, but there is little if any doubt that the superintendent is given authority to require, from fabricating as well as field contractors, evidence of ability to perform acceptable welding.

(2) Welding operators, whether on shop or field work, are required to obtain certificates of qualification from the superintendent and to renew same annually as long as they perform work under the New York code. Proof of qualification is to depend on an examination, including strength tests and inquiry into experience. Whether or not re-examination will be required annually will depend on rules to be adopted. Certificates may be revoked on account of poor workmanship or negligence.

A very singular clause has been inserted requiring welders (but not other classes of workers) to be United States citizens.

(3) The scope of application of fusion welding (meaning arc or gas welding) is unlimited, but the clause allowing its use in place of or in combination with riveting or bolting includes the condition "if done under rigid inspection and specification, in accordance with the rules of the Board."

The evident intention to impose especially strict regulations upon the use of welding does not appear to the writer as unfair discrimination in view of the undoubted fact that welding and carelessness make an uncommonly bad combination. To be sure, the power to make things difficult for those wishing to use welding might be so abused as to make the method unduly expensive, but strictness within any reasonable limits will not be objectionable to those who want welding to keep up its excellent safety record in building work.

(4) Resistance welding, which is entirely or mainly a manufacturing process, is permitted in the production of steel joists.

(5) "The architect or engineer designing or supervising the construction of a welded structure shall be experienced and skilled in such work."

No attempt has been made to prescribe how much experience in welded construction shall be necessary for eligibility, but it is clear that experience in steel construction will not be sufficient unless it has included some welded work. While too lenient interpretation might nullify any effectiveness of this clause, the officials will evidently have authority to refuse a permit for welded construction unless someone with first-hand experience in such work is to take professional responsibility for safe design and workmanship.

All or partly welded?

It is interesting to wonder but impossible to predict whether the early growth of welding practice in New York will be mainly in the field of fully-welded structures or along lines of miscellaneous welding for special purposes. The formalities surrounding welding under the code may make it uneconomical to introduce small amounts of welding into a structure. On the other hand, the administration of the code may be less strict in cases of minor applications than for all-welded buildings.

Many New York City building operations have already included limited amounts of welding for such purposes as fastening connection angles to column-base slabs, attaching shelf plates or angles to spandrel beams and other incidental applications where strength was considered relatively unimportant. Possibly similar uses of welding will be permitted under the new code without enforcement of all the precautions considered necessary in welding vital connections.

In contrast to such minor applications, one large building with which the writer was connected was completely shop-welded and was erected by welding in New York City this year. It is the east addition to the Brooklyn State Hospital and comprises somewhat over 600 tons of framing, rigidly wind-braced. The building code of the city was not involved because the operation was controlled by the state.

It is a matter of historical interest, not widely known, that the first all-welded building ever constructed was erected in Brooklyn in 1920. It is occupied by a welding contractor at the foot of Court Street.

Owners, architects and engineers who may be interested in welding only from the noise-abatement angle should know that field welding of shop-riveted framework is entirely practicable but rarely if ever saves any expense in comparison with all-riveted work. The possibilities of welding as a means of reducing cost depend mainly on saving steel and fabrication and are not realized in shop-riveted work. The familiar practice of specifying turned bolts in reamed holes, to avoid field riveting, is more expensive than field riveting or field welding if the fitting is carefully done under strict inspection, and is no better than common bolting if done otherwise.

Chicago Building Code Advances

Decision to revise, chapter by chapter, is followed by submission of six chapters to the city council

FOR TEN YEARS revision of the Chicago building code has been under way. An eminent group of engineers and architects worked long and faithfully, and as long as three years ago the task was considered substantially complete. However, as the result of many public hearings during the past two years it was concluded that too much controversial matter is included in the new code draft to permit its adoption as a whole, and orders were given to pick out those chapters on which there was essentially unanimity of opinion.

Consequently, on Aug. 5, six chapters were reported to the city council and ordered printed. Two of these chapters, 1 and 3, are general in nature while Chapters 34, 35, 36 and 39 cover loads and stresses, foundations, wood construction and reinforced concrete. Chapter 40 on steel construction is not included in the present presentation to the city council, but seven special rulings of the building department, including approval of welding, have amended the old code so that it gives effect to most of the proposed code revisions which are based on American Institute of Steel Construction specifications. Some of the important provisions of the new chapters, now up for adoption, follow.

Under the chapter on loads and stresses the principal changes from the old code relate to reductions in live load for certain occupancies and a change in the provision for wind loads. Single and multiple dwellings and hospital ward rooms are reduced from 50 to 40 lb. per sq.ft. Exhibition rooms, light manufacturing space, assembly rooms with fixed seats and restaurants are reduced from 100 lb. to 75 lb. Stairways and fire escapes are established at 100 lb. whereas the old code did not

stipulate a minimum live load for stairways. The old code required a horizontal wind resistance of 20 lb. per sq.ft. This is increased to 30 lb. on surfaces higher than 275 ft. above grade and also applies to signs, tank towers and similar structures at whatever height. The wind load for the part of buildings below the 275 ft. level is increased to 25 lb. per sq.ft. All materials permitted to be used in buildings or structures are required to meet the standard specifications of the A.S.T.M.

The new chapters require that the architect or engineer responsible for the design shall certify on the working drawings that they conform to the design drawings on which a building permit was secured, the certification covering size of members and adequacy of connections.

Foundations

In addition to the types of foundations included in the old code—spread footings, piles and caissons—the new chapter includes two additional types, namely, metal pipe piles and foundation columns. The new chapter also includes changes in the allowable loads on some kinds of soils and makes provision for several classes of soil not provided for in the old code. In all, twelve different types of soil are covered by limiting unit loads. Provisions are included for soil tests in any cases of uncertainty or wherever higher bearing values than those tabulated in the ordinance are requested. The new chapter requires that caisson rings be left in place. Foundation columns, if drilled into the rock at least 3 ft., are allowed a bearing pressure three times that permitted if their base is placed less than 1 ft. below the solid rock surface.

Piles may be jetted, but load tests must be made every 70 ft. in each direction. Pile driving formulas are listed as follows for wood piles:

For drop hammer

$$P = \frac{2Wh}{S + 1.0 \text{ in.}}$$

For single-acting hammer

$$P = \frac{2Wh}{S + 0.1 \text{ in.}}$$

For double-acting hammer

$$P = \frac{2Wh\ (Am\text{-}W)}{S + 0.1 \text{ in.}}$$

In these formulas, P is the allowable design load in lb., S the average set in in. for the last 6 in. of driving, h the fall or stroke in ft., W the weight of the hammer or the moving part in lb., A the piston area in sq. in. and m the mean effective steam pressure in lb. per sq.in., assumed at 85.

For concrete and composite piles, using either a single-acting or double-acting hammer,

$$P = \frac{2E}{S\ (1 + \frac{0.3W}{W})}$$

in which E equals the energy in ft. lb., which is Wh for a single-acting hammer and $h\ (Am + w)$ for a double acting hammer; W equals the weight of the pile and w equals the weight of the moving parts.

Wood construction

The new chapter provides for all grades of structural timber the correct stresses and formulas for wood beams and columns which were not covered in the old code. The new chapter also includes new grading rules and stresses and covers requirements for the design of wood trusses, giving maximum loads for bolts and bolted connections. The effect of the new chapter is to reduce the allowable stresses for No. 1 dimension lumber and to increase the allowable stresses for all structural grades.

Reinforced concrete

The basis for the new chapter on reinforced concrete is the 1936 building regulations of the American Concrete Institute, although changes and additions are included. Recognition is given to light-weight aggregate and to composite beams formed of structural steel beams encased in concrete. The new chapter bases the allowable strength of concrete on the water-cement ratio and provides for increases in unit stresses on reinforcing steel. Cinder concrete is not allowed either for structural or fireproofing purposes although cinder concrete units are permitted for partitions and non-bearing walls. The new chapter also requires that concrete be maintained at a temperature of at least 50 deg. for 72 hr. after placing, which replaces a provision that the concrete be "kept at a temperature above freezing for at least 48 hours."

The principal change from the A.C.I. building regulations is in the design of spirally-reinforced concrete columns for which the maximum permissible load is based on core area rather than on gross area.

F. J. Thielbar is chairman of the commission for revising the building code appointed by Mayor Kelly three years ago after a previous commission had seemingly reached a stalemate. Other structural engineers on the commission are A. J. Hammond, P. L. Hein, R. R. Leffler, B. B. Shapiro and C. H. Westcott. Also aiding in the revision of the structural chapters have been F. A. Randall, T. L. Condron, A. F. Stein, Magnus Gunderson, V. O. McClurg, D. B. Rush (deceased), J. E. Sanderson, Albert Smith, Henry Penn and J. B. Thompson.

Reservoir Seepage Traced to Earthquake

COMPLAINTS made by residents in the neighborhood of the San Pedro Reservoir in Los Angeles that water was seeping into their basements led to the discovery of a crack in the bottom extending the full length of the reservoir. Test holes drilled around the reservoir showed that the ground was saturated with water. The engineers concluded that the crack probably resulted from the 1933 earthquake. The bottom contained many small cracks as the concrete was not reinforced.

As reported in the recently issued annual report of the Board of Water and Power Commissioners repairs were made as follows: The major crack and all serious other cracks were cut out and filled with concrete. The bottom was then paved with 2-in. of flexible asphalt concrete containing only fine aggregate. All wall cracks, which were not large in number, were repaired by the Aquatite process. Tests after refilling showed only a small amount of leakage.

The Case for PWA

An inside view of the situation to which WPA operations have brought the construction industry, and what the industry can do about it

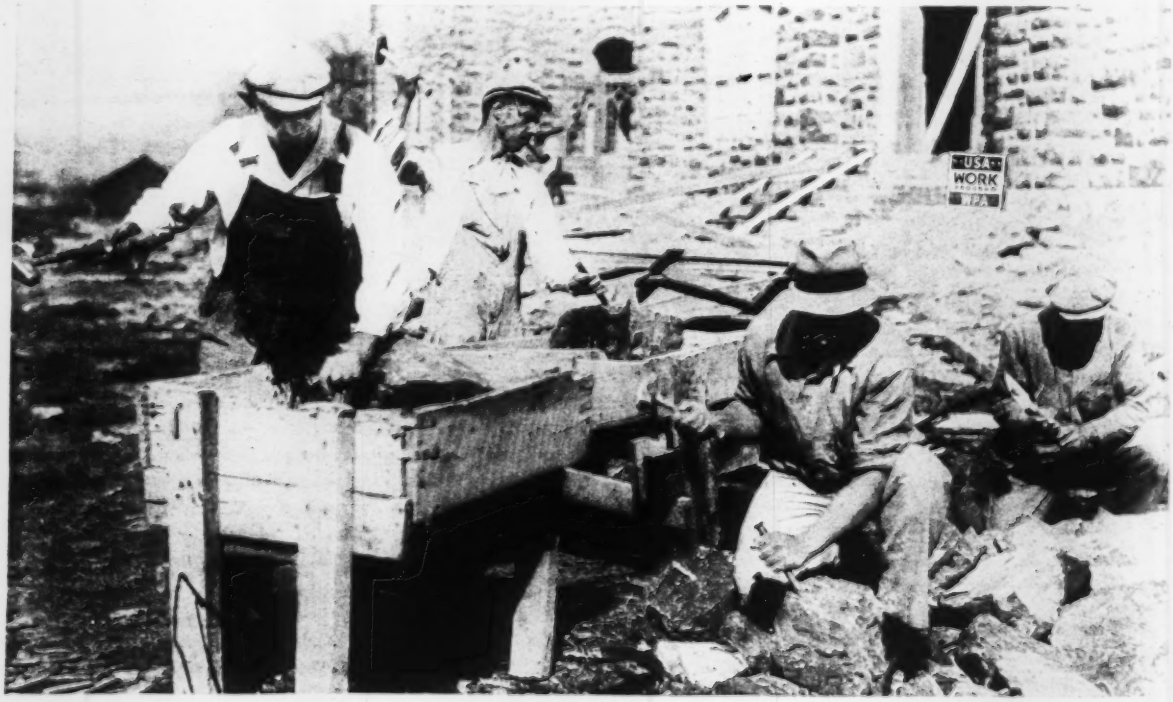
Two and a half years ago, simultaneous with the creation of the WPA to provide mass work-relief, the President proceeded to liquidate the Public Works Administration—the well known PWA. At first the new work-relief agency was restricted to small jobs. Soon, however, it invaded the field of major construction which the PWA had been carrying on, and relief-roll labor displaced self-supporting craftsmen and construction workers. Fully as bad was the effect on the construction industry, as outlined here by an inside observer who must remain anonymous for obvious reasons. —EDITOR

A LITTLE OVER four years ago, during the famed hundred days, Congress passed a law "to provide employment and to revive the construction industry". This law created the Public Works Administration, since known as PWA. Ably managed, PWA has brought about the construction of 24,000 projects all over the country—cost, around $4,000,000,000—working at all times through the normal channels of the construction industry. Most of these projects are completed, and PWA is now starting on its fourth program.

Hopkins enters the picture

But this huge revival and re-employment job could not be started fast enough in 1933. There was no adequate preparation for PWA. Engineers and architects worked far into the night, often all night, for weeks on end, yet the first six months saw only few men put to work on construction sites, while hundreds of thousands were on unemployed rolls. True, several hundred millions of dollars of orders were beginning to send life through the stagnating channels of the heavy industries, yet the rolls continued to grow longer.

To meet this need, President Roosevelt called in Harry L. Hopkins to begin a series of employment-creating measures, starting with the CWA and ending up with WPA. These measures were eminently successful in doing what they set out to do—create employment. Sewing projects were started, art projects, teaching projects, lecture series, historical surveys, and scores of other types, to take care of the hundreds of thou-



Much work that should have been handled through normal channels was taken over by the WPA.

sands of people unsuited to construction jobs. Those fit for heavier work were set to cleaning buildings, painting, leveling streets, tearing down old buildings, doing small re-paving work, ditching and drainage and other minor construction jobs, all on force account.

This was new to the American public. Murmurs against "made work" began to be heard, and finally full-blown howls demanding an end to boondoggling and leaf-raking. Since that time it has been a constant uphill fight for the Hopkins organization to get away from those charges. Inevitably the WPA tended more and more toward solid, worthwhile construction projects.

The small white-collar projects were retained; they did what nothing else could do. But in the construction field WPA began to tackle bigger and bigger projects. The $25,000 job limitation originally imposed was evaded, eventually forgotten.

Pressure groups such as the American Mayors' Conference "put the heat on" skillfully, with the result that the 30 percent local contribution for materials became optional on the communities' part; and of course optional soon meant non-existent. And try and build a subway—as WPA is doing in Boston—with only 30 percent cost for materials! It can be done, *if* you pad up your labor cost as many communities have done; else you forget the 30 percent, as many other communities have done.

The net result of those changes is beginning to be seen by a few of the clearheaded leaders in the construction field. And that result is that the construction industry is being quietly passed by. So long as much work continued under PWA, going through the normal channels of the construction industry and enlisting local funds, the fact was not generally noticed. But in time it became apparent that WPA had taken over the construction field. Why should a city bother to spend its money when WPA would do the work free? WPA architects and engineers designed the projects, WPA draftsmen drew the plans, WPA workmen built them under WPA foremen. And that was that.

From the mechanic's standpoint, this was pretty good work. True, he couldn't earn what a contractor would pay him for a full month's work. But he got his pay whether or not weather permitted work on any day. And to make wages conform to the conflicting WPA rules of a subsistence wage and prevailing hourly wages, hours per month were reduced so low that not-too-honest men were holding WPA jobs the first half month, and circulating round and picking up extra jobs the other half.

But the construction industry is wondering. What is wrong? There doesn't seem to be as much business as there should be. Engineers don't seem to find many openings in private work. Municipalities don't take up the load as fast as they should, especially now that PWA heavy construction is sharply curtailed. And, strangely enough, when contractors do get work they sometimes cannot find mechanics as freely as they should. Yet, the burden of WPA rolls continues at staggering rate.

That last point will bear looking into. In some states there has been a shortage of skilled labor in nearly all trades, yet investigation showed that WPA rolls contained more than enough skilled men. This seemed strange, to say the least. Some clues were dug up: Work in some states is mostly union, union contractors can employ only union labor, and so skilled help not in the union could not be reached. But this explanation went only part way.

The real reason turns out to be that WPA pays the prevailing wage rate and guarantees a certain income per month. And added to that, WPA workers can take other employment to piece out, and so make an income which may exceed that of men not on relief rolls. Would you get off the WPA roll under those circumstances?

The two-part answer

The construction industry is gradually working up to the answer. It seems to include two main points:

1. Make WPA service less attractive, so that workers will take private jobs when contractors offer them. No doubt many WPA workers are unsuited to construction, but there must be many that are.

2. Liquidate WPA, as far as possible through PWA. That could not be done today, or tomorrow, or next week, without bringing about a recurrence of the early days of the depression. But it could be done in time, along these lines:

The WPA sewing projects, art projects, music projects, the whole white collar set-up, would be continued so long as necessary. The construction industry cannot take care of the people whom these types of work employ. But WPA would immediately get out of the construction business.

This latter step might be considered impossible, since the states and municipal bodies in the United States are not yet quite ready to finance their own construction work and thereby sustain the construction industry, which is still far below normal. But that is what the government's heavy construction agency, PWA, is for—to help communities carry on this work. And when carried on under PWA the work will go to the construction industry normally and be done under normal procedure.

Under normal conditions we should be able to do away with both WPA and PWA, keeping perhaps a nucleus of each for emergency use. However, this point can be attained only gradually. If the ideas just presented are followed it will be reached gradually, and with hardship to no one.

The simple fact is that returning employable mechanics to the regular channels of industry through use of PWA procedure—contract construction in accordance with regular custom and subject only to the condition that a dollar must produce 100 cents of construction value—is the direct way, *and the only sure way*, to bring WPA and PWA to an end.

What is the construction industry going to do to help this result come about?

Challenge to Construction

The author asks, What is the construction industry going to do to put an end to our two national relief agencies, WPA and PWA? His argument is that WPA must get out of the construction business first of all, and if cities are not ready to resume their own public-works construction, the PWA should be prepared to help them carry on.

Will the construction industry help to put this important reform into effect?

FIG. I. HIGH-INTENSITY MERCURY LIGHTING AT SALEM CORNERS, CONN.

Road Lighting for Seeing

by L. A. S. Wood

Chief Lighting Engineer, Westinghouse Electric & Manufacturing Co., Cleveland, Ohio

The principles of night visibility are known and the processes and equipment for securing it by the proper selection and placing of lights are well formulated

A well-considered technique of highway lighting now exists. The results of recent invention and experiment presented in preceding articles (*ENR*, Aug. 5 and 19 and Sept. 2) have been coordinated by illuminating engineers to produce a code of practice. Prepared by a committee of the Illuminating Engineering Society, this code outlines briefly and categorically the principles and requirements of effective highway lighting. Using the code as a basis and quoting it as needed, this article discusses the science and reasoning upon which the practices advised are founded. Adapted with engineering judgment to controlling conditions these practices provide sound rules for design and construction in road lighting.

The code defines highways as "traffic ways which have no more than four intersections per mile, and on which there is little pedestrian traffic." By this definition discussion is limited to interurban highways and excludes city streets.

Highway lighting includes the illumination of straight highways, curves, hills, underpasses, bridges, cloverleaf intersections, traffic circles and grade crossings, all of which require special study and treatments. It involves the illumination of long stretches of roadway, the surface characteristics of which may vary constantly in color, texture and reflection factor. In brief, it resolves itself into a problem of designing an overall lighting system which will be equally effective on dark and light pavements and in dry or wet weather, with special treatments for the other factors enumerated.

The tasks then are diverse but they all resolve into the single purpose to provide effective visibility for the automobile driver. It is this objective that is the main consideration in modern highway lighting.

Objects are seen at night by either of two entirely different processes: The object may be illuminated with sufficient brightness that every detail is observed (discernment by surface detail), or the object may be discerned as an outline contrasting with the pavement beyond, which, under a system of fixed lights, is generally brighter than the object observed. (discernment by silhouette).

Discernment by surface detail and discernment by silhouette are, to a considerable degree, mutually opposed. More light on the object provides better discernment by surface detail and poorer discernment by silhouette because the brighter the object, the less it contrasts with the background. Conversely, more light on the background and less on the object provides better discernment by silhouette and poorer discernment by surface detail.

Visibility by Headlights—Objects on or immediately adjacent to the highway are seen at night in the illumination of automobile headlamps "by the light reflected from the objects toward the automobile driver. They are visible in proportion as light reflection from their surfaces is good or they may be visible because they are naturally darker or lighter than the more distant pavement as lighted by the headlamp beams. When seen against the pavement illuminated by approaching headlamps, they appear as silhouettes."

There are certain limitations in automobile headlighting which must be recognized before the advantages of adequate highway lighting can be fully appreciated. When the pavement is light in color and the road surface is dry, headlamps provide safe and pleasant night driving conditions at moderate speeds except for the glare of approaching automobile headlights. When the pavement is wet, on the other hand, instead of diffusely reflecting the light (like blotting paper), it reflects the light specularly (like a mirror) with the result that the headlamp beams are reflected in a direction away from the driver's eye leaving the pavement absolutely black. In this case, objects are seen only by the light reflected from them toward the driver; and since such objects are predominantly dark in color, their visibility is low.

On dark, dry pavements also, predominantly dark objects are seen only by the light which they reflect back to the driver's eye.

Many improvements have been and still are being made in automobile headlights but there is one major limitation which cannot be overcome —legislative limitation of beam candle-power. Furthermore, long-continued and intelligent efforts have conclusively established the impracticability under actual driving conditions of controlling headlight glare to a point where it will produce no material discomfort and no serious reduction in visibility.

Headlights are needed on automobiles, of necessity, so that we can see at all on unlighted highways, but as a satisfactory solution to night driving under all varying road surface and weather conditions, they fall far short of the ideal.

Visibility by Fixed Lighting—At the relatively low levels of illumination economically possible with highway lighting, discernment by silhouette is recognized as the best method of producing effective night visibility. The problem, therefore, is to provide a maximum of surface brightness for the automobile driver against which objects may be seen in silhouette and so that the pavement surface shall appear bright to the motorist, it is important that much of the reflection of light from it shall be toward the driver. An adequate and effective highway lighting system should produce this surface brightness under all changes in road surface conditions. The ideal to aim at is uniform surface brightness, although in practice, it is relatively unimportant that this brightness should be uniform.

"Brightness may be expressed in foot-lamberts. A foot-lambert is a unit of brightness equal to the average brightness of any surface emitting or reflecting light at the rate of 1 lumen per square foot. The average brightness of any reflecting surface in foot-lamberts is, therefore, the product of the illumination in foot-candles by the reflection factor of the surface." The crux of this definition then follows: "*The reflection factor and hence the brightness of any surface containing an element of specularity is affected by the angle of incidence of the light and the angle from which the surface is viewed.*"

It is a simple problem to design a lighting system which will produce uniform brightness on a light dry road because the light from lamps located adjacent to a highway, on striking the road surface, will be diffused in all directions and produce brightness on the road surface when viewed from any or all directions. Fig. 2 is a schematic illustration. To produce surface brightness on a dark road or wet road, however, requires careful study and involves refinements in lamp placement and luminaire design (Fig. 3). Most roads possess an element of specularity, and a lighting system which is effective on a wet road surface should provide adequate visibility on a dark, dry surface. In addition, it will produce effective brightness on a light, dry road.

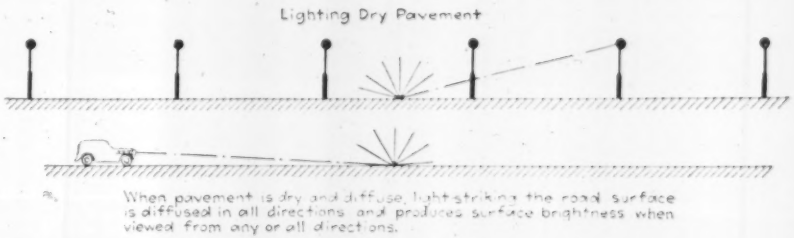

Lighting Dry Pavement
When pavement is dry and diffuse, light striking the road surface is diffused in all directions and produces surface brightness when viewed from any or all directions.

Fig. 2. Light diffusion on dry road makes uniform surface brightness comparatively easy to obtain.

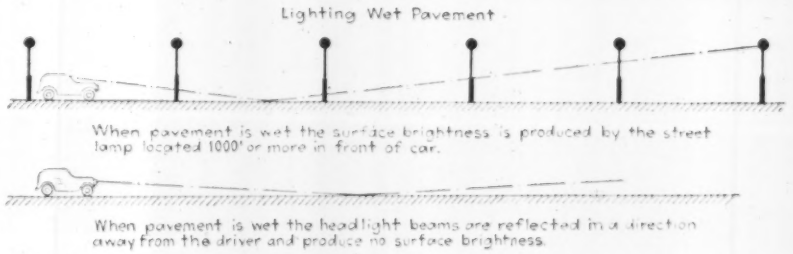

Lighting Wet Pavement
When pavement is wet the surface brightness is produced by the street lamp located 1000' or more in front of car.
When pavement is wet the headlight beams are reflected in a direction away from the driver and produce no surface brightness.

Fig. 3. A wet pavement acting like a mirror makes surface brightness hard to obtain.

Effect of Glare—Quoting the code: "Problems of spacing, mounting height and equipment are interwoven and mutually dependent. All illuminating engineers are agreed that a large proportion of the light which is provided should be delivered on the roadway and that it should be accomplished with the most uniform practical distribution of brightness and with the *least* possible glare."

The term glare is applied impartially to the discomfort experienced from a brilliant light source contrasting with its background, and to the decrease in visibility resulting from

the blinding influence of the light source. The former condition is known as discomfort glare and is particularly disturbing in highway lighting where the background of the light source is predominantly dark. The latter condition, known as blinding glare, is the effect of the total emission of the light source in the direction of the observer and the angle the glare beam makes with the line of vision.

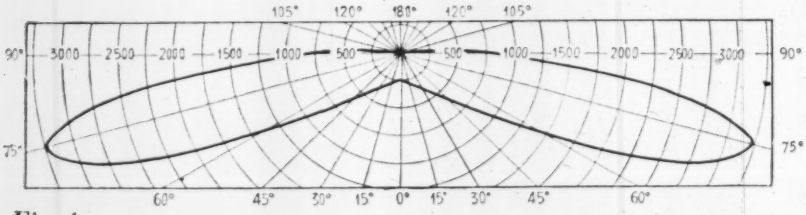


Fig. 4. Light distribution in the vertical plane that acceptably approaches the ideal.

Discomfort glare can, in some measure, be controlled by the design of the luminaire. Blinding glare can be mitigated either by reducing the spacing-mounting-height ratio and keeping the light distribution of the luminaire within the range of lower blinding glare values or by increasing the mounting height and maintaining the spacing ratio and light distribution constant.

High luminaire mounting, permitting correspondingly wider spacing with equally effective light distribution, appears to be the most satisfactory solution of the glare problem as it applies to highway lighting. A suitable balance between these conflicting considerations seems to be a mounting height of not less than 30 ft. with a light distribution associated with a spacing-mounting-height ratio of 8 to 1. Under these conditions, glare is kept within permissible limits and installation costs reduced to a minimum.

The luminaire (lamp, reflectors, shades and attachments) and the light source (filament or gaseous) are developed in various forms for specific conditions as illustrated in the article (*ENR*, Aug. 5) presenting the general survey of road lighting by S. G. Hibben. Design as considered here relates only to selection and road location.

Luminaire Design—With a specular pavement and a straight highway, the distant luminaires, even up to 1,500 or 2,000 ft. in front of the car, contributes more to the brightness of the roadway several hundred feet ahead of the automobile driver, than the nearer lamps providing that such distant luminaires emit some light at 88 to 90 deg. from nadir. It is, therefore, desirable that the luminaire should have some emission at 90 deg. and the angles immediately below. For a spacing-mounting-height ratio of 8 to 1, the maximum candle-power emission, in the vertical plane, should approximate 75 deg. from nadir (Fig. 4).

The light source in luminaires with the characteristics above described, is unshielded. So-called shielded light source luminaires, for use with smaller lamps than those recommended for the unshielded type, are designed for a spacing-mounting-height ratio of 4 or 5 to 1, and are provided with an absolute cutoff approximating 80 deg. from nadir.

Proper conservation of generated lumens requires that the upward emitted light be directed into useful emission, and that the side-emitted light, otherwise wasted, be redirected so as to light the highway.

With properly designed luminaires and with judiciously selected spacing-mounting-height ratios, it should not be necessary for the automobile driver, traveling along a lighted highway, to lower his sun visor to shield his eyes from possible glare beams emitted by successive luminaires.

Luminaire Placement—Pavements when dry are predominantly diffuse; when wet, they are predominantly specular. In the design of an overall highway lighting system, these two entirely different conditions require a common solution. Fortunately, the system which will produce adequate surface brightness for the motorist on a wet pavement, will also provide effective visibility on a dry pavement.

"In order that the pavement surface shall appear bright, it is important that much of the direct reflection of light from it shall be in the direction of the motorist." On specular pavement "with lamps placed at the side of the highway, such direct reflection is largely transverse and the . . . pavement does not appear very bright to the motorist . . . It is, therefore, important that the light sources shall be mounted well out over the pavement" at a minimum distance of 5 ft. in from the curb and preferably more. "It is advantageous to mount luminaires on the outside of highway curves and at the crest of hills and grades. The planned spacing should be adapted to locate luminaires at these and other critical points."

For two-lane highways, it is satisfactory to locate the luminaires on one side of the highway. For three- or four-lane highways, the luminaires should be located on both sides of the roadway in staggered arrangement. Highways with islands or parkways separating opposite-bound traffic should be regarded as two separate highways and treated accordingly.

It should be noted that highway luminaires are designed for definite spacing-mounting-height ratios and that these limits should not be ex-

Fig. 5. Types of light poles used in Conn., (c) Lathams Corners.

ceeded. The importance of locating the luminaires over the pavement and the adherence to the definite spacing-mounting-height ratios, justifies the installation of special poles to support luminaires in their correct locations.

Luminaire Supports—A considerable amount of money is being expended on roadside beautification and aesthetic considerations require that the poles supporting highway luminaires should be as inconspicuous as possible. Steel poles with simple mast arms to place the luminaire out over the pavement are recommended. Examples are shown by Fig. 5. Orienting pulleys to lower luminaires for servicing without interrupting highway traffic also is recommended.

Light Sources—Recent invention has produced several types of gaseous conductor lamps, two of which appear to be especially suitable for highway lighting; these are the sodium and the high intensity mercury lamps. Because of its high efficiency and the monochromatic character of its light, the sodium lamp appears best adapted for lighting long stretches of highway. At present, this lamp is available in the series type in 6,000 and 10,000-lumen sizes. These lamps are suitable for use with the unshielded type.

The 400-watt high intensity mercury lamp is also suitable for unshielded light source luminaires and it has been suggested that on lighted highways, the mercury lamps should be installed adjacent to dangerous intersections or grade crossings to indicate, by its contrasting color, the presence of danger spots. This lamp is also suitable for lighting dangerous intersections on unlighted highways.

A new series Mazda lamp with a bar type filament, known as the prefocus, bi-post lamp, has been developed for use with the shielded light source luminaries. This lamp is available now in the 4,000-lumen size and possibly will be available soon in the 6,000-lumen size.

Recommended practice

With the information and equipment described, general rules of lighting practice have been developed.

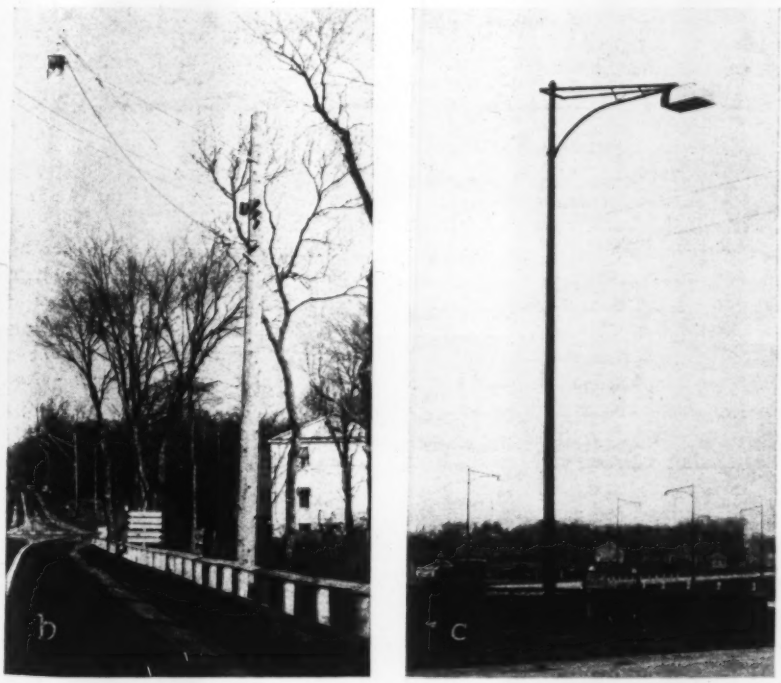
Light Intensity—The I.E.S. code includes a table of the illumination intensities which should be provided on highways. This table differentiates between three types of pavement: (a) those permanently light in color; (b) darker pavements, oil polished, and (c) dull, black pavements.

For pavements permanently light in color, the code recommends illumination of the order of 0.2 to 0.5 lumen per sq. ft. delivered on the pavement surface; for darker pavements, oil polished, the code recommends 0.3 to 1 lumen per sq. ft. and for dull black pavements, illumination of the order of 1.0 to 2.0 lumens per sq. ft. The code says: "Illumination on the pavement surface, which is here recommended, may be obtained in a variety of ways, as by larger illuminants spaced more widely, or smaller illuminants spaced more closely . . . The best selection . . . may vary with local circumstances." The illustrations, given in the code of spacings and lamp sizes "are based upon more common pole spacings, but the growing tendency to separate the light poles from the rural line will free the lighting design from such restrictions."

Since the problem of highway lighting resolves itself into the design of an overall lighting system which will be equally effective on dark, light or specular pavements, it would appear desirable to provide a system which will take care of average adverse pavement conditions. Illumination of the order recommended will be provided by 10,000-lumen sodium-vapor lamps mounted in luminaires as previously described, and installed with a spacing-mounting-height ratio of 8 to 1.

Character of Circuit—Long electrical circuits, such as are necessary with highway lighting, and the desirability of keeping line losses within reasonable limits without involving excessive line investment, definitely establish the series circuit as the type to be employed in highway lighting. Both the series sodium and the series bi-post Mazda lamps operate at 6.6 amp. and thus a 6.6-amp. series circuit will be required.

The sodium lamp in the unshielded type luminaire with a minimum mounting height of 30 ft. will require about 22 units per mile for a straight highway. The circuits may be conveniently divided into 10-mi. sections and with the 10,000-lumen series sodium lamp, one 30-kva. pole-type regulator will be required for each 5-mi. section. For convenience, two 30-kva. regulators may be installed every 10 mi. serving the lamps



recent highway lighting installations: (a) Lynn, Mass., street, (b) Salem Corners, N. Y., traffic circle.

in opposite directions and controlled by one time switch and two oil switches.

The sodium lamp requires a higher starting voltage than its operating voltage and so that regulator capacity may be kept at a minimum, a time relay is installed in each circuit which will permit the operation of one section of the circuit until the lamps in this part of the circuit are in full operation. At this time, the relay will connect the second section of the circuit thus leaving sufficient regulator capacity available to take care of the starting voltage of the balance of the lamps. Such an arrangement as this will require one feed point from the power circuit every 10 mi.

The series bi-post Mazda lamps will not require any provision for additional starting voltage and the additional regulator capacity will permit the use of longer circuit sections.

It is estimated that the cost of installing a system of 10,000-lumen series sodium lamps, spaced 210 ft. apart and mounted 30 ft. above the pavement, with one 30-kva. constant current regulator and control equipment every 10 mi. and with the luminaires installed on tubular steel poles with suitable mast arms and orienting lowering gear, will be in the order of $4000 per mile (on the basis of a unit installation of 30 mi.). This is less than one-tenth of the cost of constructing an average modern highway.

Special Treatments—There is considerable discussion as to the best way of treating special locations such as underpasses, bridges, cloverleaf intersections, traffic circles, and grade crossings as they occur on highways.

Closer spacing should be used at cloverleafs and traffic circles and the lamps should be located on the *outside* of curved roadways. The spacing should be such that, when an automobile is opposite any lamp on the curve, a straight line drawn from the driver's eye to the second lamp ahead will not intersect the lesser radius edge of the pavement (Fig. 6). Such an arrangement will provide adequate surface brightness for the automobile driver at any point on the curve.

The desirability of indicating grade crossings or unusually hazardous locations on lighted highways by different-colored lighting has been mentioned and on a sodium-lighted highway, lamps adjacent to these locations might with advantage be of the high intensity mercury type. If, with the eventual development of highway lighting, this practice becomes general, it would seem desirable to use the same type of light source (high intensity mercury) to illuminate grade crossings or dangerous intersections on *unlighted* highways.

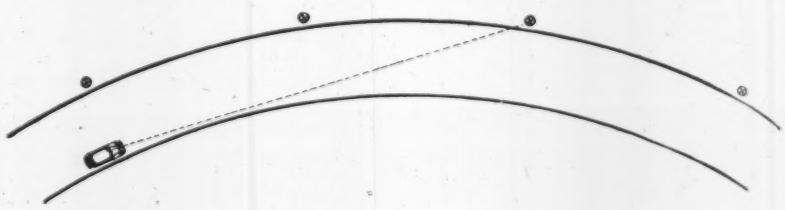


Fig. 6. Light spacing on curves should keep light ray from second lamp within pavement.

While the desirability of illuminating so-called hazardous locations on unlighted highways is established, there is some question as to the advisability of lighting them to the degree or with the same type of equipment recommended for overall highway lighting systems. Also there is some difference of opinion among engineers in regard to the illumination of highways within urban limits. There is, however, substantial agreement that such highways need not of necessity be lighted with the same type of equipment and to the same degree as are recommended for interurban highway lighting. Such highways afford an opportunity for grading the intensity of illumination from the level of the urban lighting, to the level of the interurban highway lighting, thus avoiding abrupt changes in illumination level when passing from urban lighting into interurban highway lighting. Asymmetric luminaires, of the shielded light source type, equipped with Mazda lamps, are recommended for this application.

The code states "Of the total lumens provided under usual conditions, 20 to 50 per cent are delivered upon the highway depending upon the type of equipment employed, the location of the light source, etc. As large proportions of the light flux are delivered along the highway, glare tends to become more severe unless the utmost skill is exercised in its avoidance. As glare may greatly detract from the effectiveness of the illumination, its minimization is at all times of large importance."

"No practicable increase in light output of lamps along the side of a highway can compensate for failure to locate the lamps *over* the highway."

The highway lighting system should be effective on dark or light pavements and in wet, as well as in dry weather. It should be designed to produce maximum visibility for the automobile driver (Fig. 1). Such highway lighting can be provided at reasonable cost by the following prescription:

1. Luminaires should be mounted at a height of not less than 30 ft. above the pavement.

2. Luminaires, on straight stretches of highway, should be mounted over the pavement, not less than 5 ft. in from the curb.

3. Luminaires should not be spaced further apart than about eight times the mounting height.

4. The light distribution of the luminaire should be such that light emitted from distant lamps ahead of the car strikes the road surface some distance in front of the car at a grazing angle so that the surface brightness will be visible to the driver of a modern car.

Adequate overall interurban lighting systems, extending from the urban limits of one community to the urban limits of the next, would make our highways as safe by night as by day and would go a long way towards reducing the annual toll of automobile accidents and fatalities which is apparently accepted by the public as the inevitable and logical result of increased traffic and speed.

Montana Bituminous Conference Stresses Good Subgrade Need

Meeting at Glacier Park attended by more than 400 road builders from western states

Special Correspondence

NEED for adequate base and subgrade courses was given considerable emphasis at the Montana National Bituminous Conference, held Sept. 7-9 in Glacier Park, Montana. The meeting program was devoted to thorough, comprehensive and sometimes most emphatic discussion of bituminous practices and methods developed and used by county, state and federal highway departments, asphalt technicians and laboratory workers and colleges.

Like the two previous Montana conferences, the program was devoted to the four phases believed to be the bases upon which the bituminous highway engineer depends for success: research, fundamentals (design and selection of materials), construction and maintenance. In the last-named two sections the need for better subgrade support was brought out, and it was in these two sessions that the greatest interest of the delegates centered, because of the greater ease of application to operation in the bituminous field.

In the research session the issues were perhaps not so well defined or clearcut as in previous years, indicating, probably, the tendency to attempt to put into practice research theories advanced in recent years rather than a desire to seek new fields. In the session on fundamentals, attention was given to two features which currently are occupying the thought of the bituminous engineer. The first was the desirability of using softer asphalts, the second was an examination of bitumen-aggregate adhesion for attaining weather and moisture resistance.

All told, more than 60 individual papers were prepared on the four general subjects and those papers were revised, analyzed and presented in summarized form during the conference sessions by section chairmen.

Regarding adequate base courses, Bernard E. Gray, chief highway engineer, the Asphalt Institute, New York City, who was chairman of the construction section, stated: "It has been strange indeed that, with the care required in construction of rigid types of pavement, so much has been expected of a little gravel and oil mixed together on a winding roadbed having little or no drainage. Perhaps the remarkable thing is that these mats gave as good service as they did and that from such beginnings, all subsequent betterment has occurred."

Various methods of attaining base stability were reported, some states calling for a rather arbitrary thickness of crushed stone, gravel, etc. The point to be emphasized, according to Mr. Gray's summary, is the need for a certain minimum stability under the most adverse conditions. The cheapest procedure which will accomplish the purpose is the one to adopt. He recommended attention to the newer methods of stabilization by addition of bituminous materials.

Recognition of a minimum width of 22 to 24 ft. as a safer pavement and one which is likely to be cheaper in annual cost was given in Mr. Gray's summary. The lesser cost of the wider pavement is the result of lateral dispersion of traffic and less maintenance expense than required on the narrower surfaces. Perhaps the most definite and visible trend in construction methods reported was that of substituting light road-mix methods for surface treatments or penetrations, using as little as 0.3 gal. of oil and 40 lb. of aggregate per sq. yd. in retreatment work.

The value of bituminous materials in arresting scaling of old cement-concrete pavements was brought out through reference to experimental work in Massachusetts where the practice is to prime the scaled surface with a medium curing material, apply a hot asphalt cement at the rate of about 0.25 gal. per sq. yd. and follow with a cover coat of $\frac{3}{4}$ in. stone precoated with the same material as the prime coat. The trend toward plant-mix in place of road-mix, noted at last year's Montana conference, was even more noticeable this year, although the higher cost of the plant-mix is a handicap to its universal adoption. The chief advantages of the plant-mix are the possibility of greater uniformity and closer control of the mixtures.

Maintenance section

H. H. Houk, chief engineer of the Alabama highway department at Montgomery and chairman of the maintenance section at the conference, summarized maintenance practices and experiences as follows:

"Many engineers now feel that bituminous surfaces of the proven types can be maintained and improved at far less total annual cost than any other surface yet developed and much cheaper than the so-called high-type pavements."

Many reports of excessive maintenance costs on bituminous surfaces, Mr. Houk said, result from inadequate and inaccurate cost accounting systems which cause maintenance costs on base or subgrade structures to be charged to surfaces. Many items of expense that enter the cost of maintenance are entirely independent of the type of surface used.

Mr. Houk charged the bituminous engineer with the responsibility of eliminating the so-called "inevitability" of the "spring break-up." "Spring break-ups are inevitable only on those sections improperly constructed or built for temporary or make-shift service." A decrease in the use of seal coats of bitumen without aggregate or cover material was noted. Preferred practice at present is to use seal coats that strengthen and thicken the mat and provide non-skid texture. Discussion of center striping policies of the various states brought out an interesting experiment being conducted in Iowa where side-striping is being substituted for center striping on bituminous surfaces. The

theory is that side strips will draw traffic away from the danger of side-swiping in the center.

In the research section, projects which appear to be receiving the greatest attention in the laboratory and in the field are: changes in the physical properties of bituminous materials due to aging in service, exposure during construction, and accelerated changes in thin films on mineral aggregates; adhesion phenomena and replacement of bituminous films by water; construction of adequate bases or other methods of eliminating poor subgrade conditions; relative merits of slow and medium curing asphaltic oils; effect of type and quality of mineral filler on stability of bituminous mixtures; relative merits of road mix and plant mix construction.

R. N. Traxler of the Barber Asphalt Co., Maurer, N. J., was chairman of this section.

Fundamentals

In summary, these points stood out in the individual papers prepared by those who wrote on the subject of fundamentals: The chaotic state of terminology needs remedy; the slow-curing types of road oil are being reconsidered; there is a strong support for all types of aggregate and all types of construction; there is a definite trend toward the use of softer asphalts; the aim of mixture design has turned away from maximum stability and toward combined stability, workability and durability.

A. H. Benedict, associate highway engineer, Bureau of Public Roads, Portland, Ore., was the chairman of this section.

D. A. McKinnon, chief engineer of the Montana State Highway Department, was general chairman of the conference. D. L. Cheney, bituminous engineer, Montana State Highway Department, and G. E. Everett, Western Petroleum Refiners' Ass'n., were assistant general chairmen.

Texas Gets Better Roadsides

by WINTON WATKINS
Wichita Falls, Texas

Boys on relief work add notable improvements to state roadsides under highway department foreman

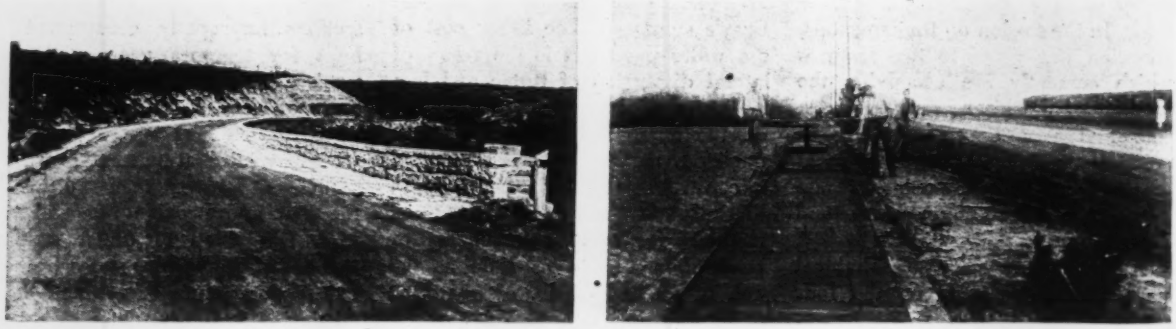
LAST YEAR the National Youth Administration, an agency of the federal Works Progress Administration that had the responsibility of furnishing employment to the youths from relief families, suggested that the Texas Highway Department prepare and submit projects for the improvement and beautification of highways. The work proposed was to be performed on public property, should not be of a maintenance nature and would not displace any regular highway employee. The following is an account of the money expended and the results obtained in one district by the administration.

The year's operation in this district cost the NYA $34,668 for labor payrolls and the Texas highway department $16,411 for supervision, materials, equipment and other costs. For this expenditure, the following work was accomplished:

Items	Unit Cost
14,320 cu.yd. excavation and fill..	$0.31
4,766 cu.yd. graveling.....	1.42
5,910 sq.yd. painting guard fences and sign posts.....	0.10
12,906 sq.yd. sodding slopes and road shoulders	0.22
86,647 lin. ft. removing and resetting fences	0.10½
6,927 trees and shrubs, planted, trimmed and cultivated.....	0.23
4,330 sq.yd. highways sidewalk....	1.02
4,800 cu.ft. of native stone retaining wall	0.59

In addition, 21 roadside parks were constructed. These parks are complete with native stone tables, benches and cooking pits, and they have also been made more pleasing by the addition of trees, shrubs, flowers and grass. A greenhouse was constructed which is now in operation and in it more than 6,000 trees, shrubs and flowers are being nursed to maturity for transplanting along the highways. A nursery was also constructed in which 1,000 young trees have already been planted.

When it is remembered that the youthful workers employed on these projects were, to a large extent, performing their first public construction work and must therefore be instructed in the proper use of tools, materials and equipment, and also taught the proper use of their time and efforts, it seems sure that the program has been successful. Looking farther, this may be the means of assisting somewhat in supplying the demand for workers skilled in the use of construction tools, equipment and materials.



Stone wall guard rail and roadside walks represent types of work on Texas roads carried out by the National Youth Administration under supervision of the state highway department

Notes on Sewage Disposal

A monthly summary of current developments conducted by Willem Rudolfs

VALUE OF FILTER FLIES—The nuisances created by the sewage filter fly are so frequently and persistently stressed that the possible value of the larvae in connection with the operation is overlooked. Blunk (*Technische Gemeindeblatt* 40, 73-77, 1937) in discussing the operation of covered trickling filters through which air is drawn, states that his experience has shown the need for large size stone on top of the filters, which gives the flies a chance to deposit their eggs in large numbers on the underside where the larvae perform their useful work. He believes that with a sufficient number of flies the filters are prevented from clogging and the film on the stones is kept in good working order. In order to make use of the larvae and of the same time prevent aerial nuisances filters should be covered and air drawn through the filter from top to bottom. The exhaust air can then be collected and the flies destroyed. When full use is made of the larvae and air is supplied the filters can be dosed continuously at high rates. The coarse stone on top should have a minimum diameter of from 1¼ to 3 inches.

WOOL WASTE TREATMENT — Woolwashing waste is undoubtedly the most highly pollutional liquid produced in the textile industry. From the earliest days of the industry it has been customary in England to treat the waste for grease recovery by acid precipitation. While it is possible to remove the bulk of the grease and a large proportion of the organic matter by this process, the effluent even when well clarified is strongly acid and contains dissolved organic matter. Recent investigations (*Report* West Riding of Yorkshire Rivers Board, April, 1934–37) at the Sutton Mills, where the wool waste has always been treated by the acid process, have shown that further treatment of the effluent by lime precipitation, gives very good results. The waste, after passing through shallow tanks for the removal of sand, flows to a storage tank from which it is pumped for acid treatment. The fatty magma is drained on filters and afterward steam-pressed for grease recovery. The acid effluent receives secondary treatment in two lime precipitation tanks and the clarified supernatant liquid is removed for final treatment on two filters. The lime sludge is dried and readily disposed of on agricultural land. This system has been adopted by a number of mills in the district.

GAS OR FAT EXTRACTION?—A considerable portion of the gas produced by sludge digestion is derived from the fats and greases present. Various types of fats, fatty acids and oils produce gas with rather high heat values, containing from 60 to 75 per cent methane. A study just published by Sierp (*Von Wasser* XI, 9, 1936) shows that many of the animal and vegetable fats found in sewage produce about the same quantities of gas. Calculations show that the monetary value of the gas produced is greater than that of the fats themselves, were they extracted, although fat prices are high and such material is in demand. Sierp believes that when 50 per cent of the non-saponifiable fats in sludge have been digested, the sludge is sufficiently ripe for drawing.

OZONE FOR COAGULATION—Ozone has been used for sterilization of water for a number of years, particularly in Europe. Experiments on sterilization of sewage by ozone have been reported from time to time but results have been rather discouraging. Principal objections are long contact periods, the large amount of ozone required with subsequently high cost, and the necessity for oxidizing most of the organic material before effective bacterial reduction is accomplished. The use of ozone as a "coagulant" has recently been investigated by Theroux (Mich. Eng. Exp. Sta. *Bull.* 74, 1937). With about 20 minutes mixing and one hour settling, using 43.5 lb of ozone per million gallons, the average suspended solids removal was 87.4 per cent and 5 day B.O.D. reduction 64.5 per cent. Electrical energy costs are about $4.35 per m. g. of sewage treated.

No experiments were made with smaller quantities of ozone and there were no comparisons with air or oxygen. Laboratory experiments, where the effect of ozone was compared with oxygen, hydrogen peroxide, air, carbon dioxide and nitrogen (Rudolfs and Gehm, Sew. Works *Jour.* July, 1937) indicate that ozone has no great advantage as an aid in flocculation over air or oxygen.

MILK WASTE—Treatment of milk waste continues to receive active attention by investigators both here and abroad. Small scale experiments have shown that waste water containing as much as 1 per cent milk can be treated provided the waste water is first stored to allow fermentation of fats and the separation of other solid matter previous to oxidation on trickling filters. English experience shows that without preliminary fermentation the filters gradually accumulate solid matter in the top layers and soon become clogged. Recent large scale experiments conducted by the Water Pollution Research Board of England (Annual Report 1936) indicate that good results can be obtained using two 25 ft. dia. rotary distribution filters; the effluent from the first filter, after being settled, is placed on the second filter.

During the last few years a number of filter plant installations have been made at milk products factories in Michigan. Results from a typical plant, consisting of storage and settling tanks followed by a 50 ft. dia. rotary distribution filter are given by Eldridge and Theroux (Mich. Eng'g Exp. Sta. *Bull.* 71). It is of interest to compare these with accomplishments in England using double filtration, dilution and rather low rates of application.

	Michigan	England
Raw waste B.O.D.	987 p.p.m.	900 p.p.m.
Primary filter effluent B.O.D.	131 p.p.m.	25 p.p.m.
Secondary filter effluent B.O.D.	...	7 p.p.m.
Reduction in B.O.D.	86.8 per cent	99.2
Application, gal./cu. yd./day	480	130

Note: In England the settled liquid is diluted with 4 volumes of purified effluent previous to filtration.

FROM FIELD AND OFFICE

Working problems and time-saving methods . . . Edited by Charles S. Hill

A Graphic Method For Obtaining Progress

JOSEPH D. RUBIN

Assistant Resident-Engineer Inspector, P.W.A. Pilgrim State Hospital, Brentwood, N. Y.

On PWA work a summary is submitted monthly in which the per cent complete for the whole project is given. By the method of weighted averages, if the whole project costs $100,000 and one contract of $20,000 is 70 per cent complete, then this is $\frac{(20{,}000 \times 70\%)}{100{,}000}$ or 14 per cent of the completion of the whole. Similarly, the proportionate weight of each contract is computed and all these percentages are added to obtain the project progress.

To have a graph of the progress of each contract and of the project as a whole, the following method was devised; its advantage is that only a simple addition is required to obtain the project progress, and that the per cent completion of each contract and the relative weights of each compared to the others are seen.

Taking the example shown: There are four contracts, *A* for $50,000, *B* $25,000, *C* $20,000 and *D* $12,500 or a total of $107,500. On a common base lay off rectangles to a height proportionate to the money value of each contract. In this case one space was taken as $1,000, so that *A* is 50 spaces higher, *B* 25 spaces, *C* 20 spaces and *D* 12.5 spaces. Since each rectangle no matter what its height, represents 100 per cent complete, percentages are laid off as shown. Since *A* has 50 spaces, each space represents 2 per cent; *B* has 25 spaces, therefore each space represents 4 per cent, etc.

The wider rectangle to the left, represents the complete project; any suitable scale is chosen. In this case, each space represents $2,000. The height therefore is $\frac{\$107{,}500}{\$\ 2.000}$ or 53.75 spaces and the per cent per space is $\frac{100}{53.75}$ or 1.86.

We now have the per cent of work complete equated to its corresponding money value on both the contract and project rectangles.

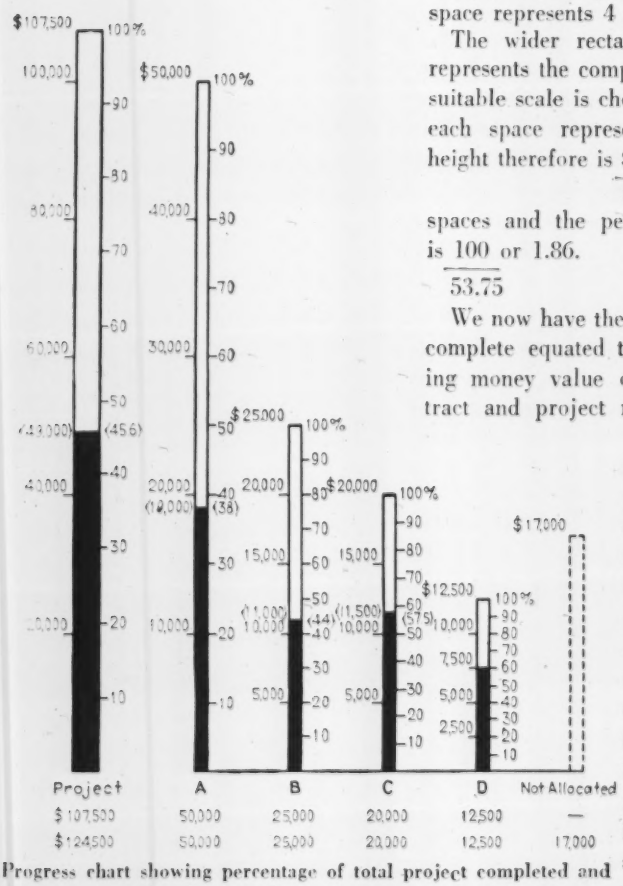
Ordinarily, the per cent complete for each contract is obtained by dividing the value of the work installed by the value of the total contract. With these rectangles, if they are filled in to a height representing installed value, the per cent complete is immediately read off for each contract. The money value and per cent complete are shown by the following table:

Contract	Money Value Installed	Per cent Complete
A	$19,000	38
B	11,000	44
C	11,500	57.5
D	7,500	60

Having the money value for all the contracts, or $49,000, lay off this figure on the project rectangle and read off the corresponding per cent, which in this case is 45.6. This is the project progress.

It frequently happens that a certain amount of money is set aside for future contracts. Let each contract remain as before, but assume $17,000 as being not allocated. The total project cost will therefore be $124,500. Erect a dotted rectangle 17 spaces high. The height of the project rectangle will increase to $\frac{\$124{,}500}{\$\ 2.000}$ or 62.25 spaces, and each space will be $\frac{100}{62.25}$ or 1.6 per cent.

As the total amount of money has not changed (the not-allocated can be considered as a contract on which zero progress has been made), it is obvious that the $49,000 will equate to a lower figure or to 39.4 per cent exactly.



Progress chart showing percentage of total project completed and percentage completed on each component contract operation.

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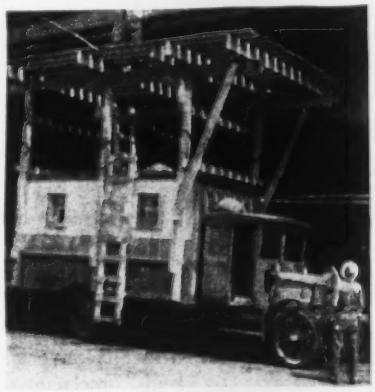
Scaffold Trucks Move Floor Forms

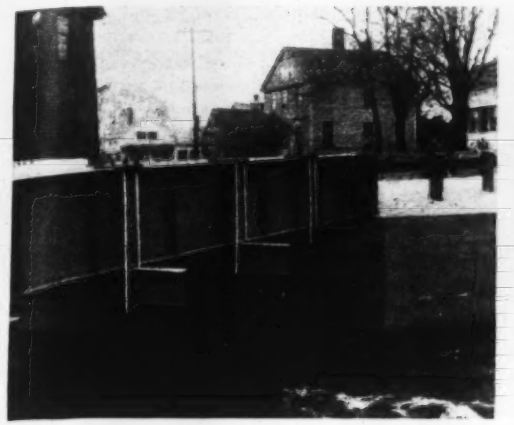
by H. D. HAMMOND

New York, N. Y.

The sub-contractor for the south abutment and concrete floor of the viaduct which will carry the West



Telescoping scaffold on a truck shifts viaduct floor forms



CAMERA MEMORANDA OF ENGINEERING AIDS

1. When floods swept away New England road bridges in 1937, the bridge at Winchendon, Mass., was quickly replaced by (1) throwing new girders across the gap, (2) hanging under-floor I-beams by rods from the girders, and (3) laying a heavy timber floor on the I-beams.

2. The state highway department of Vermont is replacing many of its old, narrow bridges with new steel-beam and concrete-deck structures, a feature of which is a continuous cable guard rail. The approaches have standard wood-post and cable guard rails, and the cables are carried across the bridges on concrete posts built into a concrete curb.

Side Express Highway in New York across the depression at 125th St. buys old trucks that can still be made to run, and uses them to handle floor forms. The truck shown is a model 1915, yet it can still navigate, both under the viaduct and around town. As shown, the contractor has built a tool house on the truck, whose frame is surrounded with sliding posts carrying a scaffold. The scaffold shown can be lowered to clear at 13½ ft., and can be raised to 23 ft. above the street. The raising and lowering, when a crane is not handy, is done under the viaduct with a block and tackle. The sliding posts are dogged when the scaffold is at the desired level by rectangular shackles of round iron, with ends of ¼-in. plate, which bite into the posts when the shackle tilts.

Several men, working on the wide, solid platform, can take out a form from under the floor quickly and easily and stow it on the deck of the rig. The old truck then staggers forward with the load, and stops under an open panel ahead, where the floor form is re-erected.

$3 to $5

paid on acceptance for items suitable for the pages of From Field and Office.

Simple Water Purification for Camps

by FRANK B. KING

Civil Engineer, Oklahoma City, Okla.

Water supply for camps of CCC workers on forest roads in southeastern Oklahoma was provided by the simple purification plants illustrated. To meet purity demands at low cost, the canvas-tank purification idea for troops in the field was adopted and enlarged upon by using concrete tanks instead of the canvas. Settling tanks were built to hold two days' supply and, for flexibility in operation, were divided into two compartments. This allowed for settlement in one side while water in the other was being drawn for use. The tanks were built with a trough bottom and sludge outlet, and the clear-water pipe was set in about 1 ft. above the bottom. A single chlorinating tank was built to hold 1000 gal., as the purification could proceed much more rapidly than the sedimentation.

Small water-purification plant for camps

The locations were on a side hill to permit full operation by gravity. A pump near the river pumped the water into the large tanks where the proper amount of lime and alum was stirred in with a wood paddle. After settlement the smaller tank was filled and the water was thoroughly mixed with a solution of chloride of lime. When purification was complete the water was pumped to an elevated storage tank. No filter was needed but one could be built between the other tanks.

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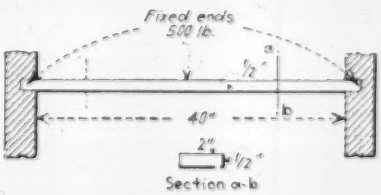
Will You Answer:

The readers of *Engineering News-Record* often ask its help in solving problems that puzzle them. Here is one: "Which will deflect the most under the conditions shown by the sketch—cast-iron or steel?" Now the answer is not too simple. We have sent ours but some reader may know a better one. Let us have it.



Will cast iron or steel be stiffer?

THE WEEK'S EVENTS

Continued from page 495

Anti-Strike Law Voided In Colorado

In a complicated labor dispute, the Denver Building and Construction Trades Council, A.F. of L., lost the specific point at issue but won an important victory in a long fight against a compulsory arbitration law which has been in effect in Colorado since 1915. The case arose out of a verbal agreement which A. F. Horner, Denver contractor who is building the Williams Fork dam, a part of the Denver sewage disposal project, was claimed by the Building Council to have made to employ union labor on the dam. When on July 19 the contractor requisitioned men from the National State Re-employment Service, which is non-union, the union called a sympathetic strike on an underpass in north Denver which the contractor was also building.

The State Industrial Commission, acting under the terms of the state industrial commission act of 1915 which forbids a strike until a dispute has been subject to arbitration for 30 days, ordered the union to return the men to work. The Building Trades Council refused to do this and an injunction was sought under the terms of the 1915 law which makes an injunction mandatory under such circumstances.

In the district court decision, handed down Aug. 28, it was held that the 1915 law had been superseded by a law passed in 1933 which forbids any court to compel men to work either singly or collectively.

A week later Horner hired non-union men on the underpass job but on Sept. 9 discharged them and again employed union labor and agreed to submit the Williams Fork dispute to the State Industrial Commission and abide by its decision. On Sept. 10 the commission decided against the Building and Construction Trades Council.

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Five Irrigation Projects Planned in Montana

The Montana State Water Conservation Board is completing plans for five irrigation projects, based on a PWA allotment of $1,885,000, of which $984,000 is a grant.

The largest project, estimated to cost $776,000, involves the construction of three earth and rock-fill dams on the Musselshell River for water storage and flood control. A $449,000 project provides for an earth and rock-fill dam on the west fork of the Bitter Root River, 20 miles south of Darby. The new reservoir would increase the water supply available for present irrigated districts.

A $258,000 earth and rock-fill dam on Nevada Creek provides flood control and supplementary water storage. The fourth undertaking is the construction of pumping units to distribute water from the Yellowstone River over 4,668 acres near Sidney at a cost of $98,000, and a fifth provides for enlarging and extending an old irrigation canal near Columbus at a cost of $56,364.

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Yellowstone River Project Is Approved

An allotment of $1,600,000 has been made to the Bureau of Reclamation for construction of the Glendive unit of the Buffalo Rapids project in the Yellowstone River Valley in Montana. The money comes from funds made available by the Emergency Relief Act in 1937, and only $776,000 of the allocation is to be expended on a reimbursable basis.

The Glendive unit is a part of the more comprehensive Buffalo Rapids project which has been investigated by the Bureau with an allotment of $25,000 from the PWA. It provides for the irrigation of 17,000 irrigable acres along the Yellowstone River from Salem to Upper Seven Miles Creek near Glendive.

Because agricultulture in this area has suffered greatly from the severe drought extending over a number of years, and because of the consequent imperative need for relief work and water supply, the plans for construction of the Glendive unit varies from that ordinarily followed in building federal reclamation projects in that part of the cost is here credited to relief. This money, $829,000, will be expended for all types of labor. The construction will be done largely by force account, using all available relief labor.

Paul A. Jones, who has been resident engineer on the Gila project, has been put in charge of construction on the Buffalo Rapids project. Work in organizing the district is now in process; this must be done before a repayment contract can be executed. Work will be begun as soon as possible at a number of points on the canal system so as to utilize the maximum amount of relief labor before winter. Little skilled labor will be needed until structural work begins on the power house.

The project involves the construction of 32 miles of main canal which will cost about $376,000, a 250 second-foot pumping plant, lateral constructed, and a drainage system. Construction will require about two years for completion.

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Effect of Water Wheels On Fish Studied

The first comprehensive test of the effect of revolving water wheels on fingerling salmon was conducted Aug. 29 by the Oregon State Fish and Game Commission at the Cazadero plant of the Portland General Electric Co., on the Clackamas River near Portland, Ore., under the direction of Dr. Harlan B. Holmes, Aquatic Biologist for the North Pacific Division of the Army Engineers. The test was part of a general study of a proposed plan to re-establish runs of spring Chinook salmon and steelhead trout in the upper Clackamas River.

A total of 1700 3-in. chinook salmon were introduced into the penstock in three separate runs. A ¼-in. mesh net was stretched across the tailrace; a professional diver was stationed at the bottom of the tailrace; and four to six men with dip nets working from boats collected dead and disabled fish on the surface.

The first run of 900 fish was used to develop technique. The second and third runs of 400 fish each were considered the official test, and from these two runs 183 and 175 dead fish were recovered respectively. A total of 282 live fish were recovered from the three runs, but observers noted that not all the fish that came through alive were so recovered. It was also noted that not all the dead fish were recovered.

Dr. Holmes concluded that in this particular wheel there would be a loss of 50 per cent of all the fish passing through it.

In his report of the test, Dr. Holmes points out that different types of wheels would have a varying severity on fish passing through them. Generally speaking a high head, high speed wheel would be the most severe, whereas the low head propeller type wheel would be comparatively harmless. The wheel on which the tests were made at Cazadero would fall between these two extremes in severity. This wheel is a 5,000 hp. reaction turbine, operating on a head of 130 ft. and dunning 360 r.p.m.

Central Valley Dam Gets New Name

The proposed storage dam that is to become the key unit of the Central Valley project in California and which has been known so far as the Kennett Dam, after a railroad way station nearby, was renamed Shasta Dam by John C. Page, U. S. Commissioner of Reclamation, on Sept. 12. The dam is named after the mountain at the northern extremity of the Great Central Valley.

The commissioner pointed out that Shasta Dam, rising more than 450 ft. above the bed of the river and with a crest length of more than 2,500 ft., will be one of the world's largest concrete dams.

The northern division of the Central Valley project will continue to be known as the Kennett division and the government camp being built near the dam site will be known as the Kennett Camp.

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Road Research Station Work to Begin Soon

Plans for the research station of the Bureau of Public Roads at Abingdon, Va., have been completed and bids have been called and will be opened Oct 18. Completion of the experiment station will give the Bureau adequately equipped and housed laboratories with a considerable area for outdoor tests on a permanent location.

The Abingdon site consists of 54 acres overlooking the Potomac River. Buildings will be erected at this time to house the Division of Tests and will be of colonial design. One wing of the group of buildings will house bituminous investigations and subgrade soil research. The other wing will be used for structural tests, concrete investigations and other non-bituminous investigations. A two-story bay in each of these wings will be available for high testing equipment for impact studies and tests. A center building will be used for machine and carpenter shops and as a garage, and a small building will contain a central heating plant.

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Quiet Rules on Tunnel Work For Delaware Aqueduct

Complaints from residents of Westchester County that noise connected with tunneling operations on New York City's Delaware aqueduct, new water tunnel now under construction, had created a serious nuisance have led to an agreement between the Westchester County Board of Supervisors and the New York City Board of Water Supply under which the work will be done as silently as possible and efforts will be made to avoid disfiguring the countryside with piles of rock and dirt.

Contractors, under the agreement, will be required to pad their dump trucks and bins, to confine underground rock drilling and blasting to daylight hours as much as possible, to sharpen rock drills at isolated places, and to keep the tunnel shafts covered with silencing material. Also, dirt piles already made must be removed and dirt from excavations carried away in future.

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Tallest Building

WORLD'S TALLEST building is under construction in Moscow, where erection began July 29th of a new Palace of the Soviets, which is designed to rise more than 1,300 ft. above the city, surpassing the Empire State Building's 1,248 ft. Foundations for the building have already been completed.

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Busy Week for Engineers

Civil engineers are planning to get their fill of speech making and speech hearing during the week of Oct. 4-10. Municipal engineers and public works officials will be in Atlanta for the annual conference of the American Public Works Association. Before this group gets well started, the American Society of Civil Engineers begins its fall meeting at Boston on Oct. 4 and is to be joined by members of the Engineering Institute of Canada. That meeting will continue through Friday, Oct. 8.

Now comes the announcement that the National Society of Professional Engineers will hold its annual convention in New York Oct. 8-9, and will discuss the economic status of the engineers, including unionization versus professional society organization.

Meanwhile, of course, the engineer with a medical slant is wondering how he can squeeze in the annual meeting at New York of the American Public Health Association, which takes place Oct. 5-8.

And this is not all. While these organizations are busy in Atlanta, Boston, and New York, discussing professional and technical subjects, the Federation of Architects, Engineers, Chemists and Technicians will be gathered in its third annual convention in Detroit Oct. 7-10 to discuss "What the technical profession can do through organized efforts to secure the benefits of modern science and technology."

CALENDAR OF MEETINGS

NATIONAL SOCIETIES

AMERICAN SHORE AND BEACH PRESERVATION ASSOCIATION, mid-year conference, Chicago, Sept. 27-28.

AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS, annual convention, Boston, Sept. 27-30.

AMERICAN PUBLIC WORKS ASSOCIATION, annual conference, Atlanta, October 4-6.

AMERICAN PUBLIC HEALTH ASSOCIATION, annual meeting, New York, Oct. 5-8.

AMERICAN SOCIETY OF CIVIL ENGINEERS, fall meeting, Boston, Oct. 6-8.

NATIONAL COUNCIL OF STATE BOARDS OF ENGINEERING EXAMINERS, annual meeting, Scranton, Pa., Oct. 11-13.

NATIONAL SAFETY CONGRESS, Kansas City, Oct. 11-15.

NATIONAL RECLAMATION ASSOCIATION, annual meeting, Casper, Wyo., Oct. 12-14.

AMERICAN MUNICIPAL ASSOCIATION, annual meeting, Chicago, Oct. 13-15.

AMERICAN WELDING SOCIETY, annual meeting and exposition, Atlantic City, N. J., Oct. 18-22.

CANADIAN INSTITUTE OF SEWAGE AND SANITATION, annual convention, London, Ont., Oct. 21-22.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION, annual convention, White Sulphur Springs, W. Va., Oct. 27-29.

HIGHWAY RESEARCH BOARD, annual meeting, Washington, D. C., Dec. 1-3.

THE ASPHALT INSTITUTE, national asphalt conference, Memphis, Dec. 6-13.

ASSOCIATION OF ASPHALT PAVING TECHNOLOGISTS, annual meeting, Memphis, Dec. 6-11.

UNIVERSITY OF KENTUCKY, road and street school, Lexington, Ky., Dec. 6-9.

REGIONAL AND LOCAL

SECTION MEETINGS, AMERICAN WATER WORKS ASSOCIATION: New York, Schenectady, Sept. 30-Oct. 1; Minnesota, St. Paul, Oct. 7-9; New Jersey, Atlantic City, Oct. 15-16; Southwest, Austin, Tex., Oct. 18-21; California, Sacramento, Oct. 20-23; Virginia, Richmond, Nov. 4-6; Missouri Valley, Omaha, Nebr., Nov. 4-6; Wisconsin, Green Bay, Nov. 8-10.

SOUTH DAKOTA WATER AND SEWAGE WORKS CONFERENCE, annual meeting, Sioux Falls, S. D., Oct. 11-12.

TEXAS PUBLIC HEALTH ASSOCIATION, annual meeting, Dallas, Nov. 1-3.

PERSONAL

M. HARVEY SLOCUM has resigned as general superintendent for M.W.A.K., contractors on Grand Coulee Dam.

ELMER C. BARTON, city engineer of Princeton, W. Va. has resigned that position to become city engineer of Bluefield, W. Va.

CHARLES TOPPER has been appointed county engineer of Ashtabula County, Ohio, succeeding the late E. C. Luce. Mr. Topper was in the employ of the county from 1911 to 1935 when he became project engineer for the state highway department.

C. R. YOUNG, professor of civil engineering at the University of Toronto, has been appointed a member of the Royal Commission on Transportation recently set up by the Ontario government, to study transportation of freight and passengers by motor vehicles in the province.

ROLLIN J. SMITH has become a member of the asphalt department of the Skelly Oil Co. of Kansas City, Mo. For the past several years Mr. Smith has been secretary and treasurer of the Kansas Engineering Society, and he was formerly a design engineer of the Kansas State Highway Department.

ROSS H. BOAS has been appointed traffic engineer for the Commonwealth of Pennsylvania, to take charge of a newly established division of traffic engineering in the Pennsylvania department of highways. The new division will have authority over all traffic signs, signals and markings in the Commonwealth, including those erected in cities and boroughs.

JOHN C. REMINGTON, JR. and William A. Goff have dissolved the firm of Remington & Goff in which they have been practicing civil engineering at Camden, N. J. Mr. Goff has opened offices in Philadelphia, where he will practice private and general municipal engineering. Mr. Remington has associated himself with Henry G. Perring, Paul X. Blattler and F. C. Wachter, and formed the firm of Perring & Remington Co., Engineers, with offices in Baltimore and Camden.

HAROLD E. WESSMAN will be in charge of the newly offered graduate work in structural engineering at New York University. Dr. Wessman formerly taught structural engineering at the University of Illinois and the University of Iowa. He was also associated for a number of years with the firm of Waddell & Hardesty, consulting engineers, New York City, on the design of long span and movable bridges. He has served as consultant on secondary stress analysis and on various bridge and building investigations.

IT WAS INCORRECTLY STATED in the August 26, 1937 issue, page 368, that Harold W. Baker, John H. Heckathorn, Callis H. Atkins, Earl R. Bennett, and Raymond B. Krum, had been enrolled as lieutenants, junior grade, in the Navy Civil Engineer Corps. These men were appointed to the reserve corps. No additional officers have been taken into the civil engineer corps of the navy since the appointments made as a result of the examinations held last year. Nine officers are now on the waiting list but no vacancies have occurred in the regular service.

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Extension Contract Let For London Tubes

Contract has been let by the Great Western Railway for a double electric line from North Acton to Greenport, and of a large car depot at Ruislip, according to an item in the August 27 issue of *Engineering*. The contract constitutes the initial step in the scheme arranged jointly by the Great Western Railway and the London Passenger Transport Board to extend the Central London Tubes to Ruislip, a distance of eight miles. The program of work to be immediately undertaken comprises the widening of the line from two to four tracks between North Acton and Ruislip, and the electrification of the new lines on a low-voltage, fourth-rail system.

The car depot will be of the most modern type, double-ended, and there will be equipment for the maintenance of cars, for automatic washing and for vacuum cleaning.

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Argentine Highway Program

In the course of its program of highway construction started five years ago, 1,500 miles of paved highways were constructed and 6,900 miles of good earth road at an outlay of about $60,000,000, it was announced recently by President Justo.

Completion of the program, including roads completed and others ready to be started, will involve construction of 7,000 miles of paved highway and 15,000 miles of earth road. The cost of this immediate plan, which includes the building of 200 bridges, will be about $100,000,000.

OBITUARY

A. G. WRIGHT, partner and treasurer in the firm of Jennison Wright of Toledo, Ohio, died Sept. 9.

PETER OLECHOWSKI, 65, a civil engineer who had been employed for the past 34 years by the Detroit public school system, died Sept. 4 in Newport, Mich.

GEORGE O. ARNOLD, city manager of Bozeman, Mont., and formerly a civil engineer for the Chicago, Milwaukee & St. Paul, Railroad, was drowned Sept. 9, when he fell into a city reservoir which he was inspecting.

ALEXANDER E. KASTL, a retired civil engineer, died in Pelham Manor, N. Y., Sept. 8, at the age of 75. Mr. Kastl, a graduate of the University of Michigan, was engaged for many years on municipal projects in Massachusetts and was for a time in the engineering department of the New York City board of water supply.

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Change to Standard Gage On Japanese Railway

A gradual adoption of the standard 4 ft. 8½ in. gage on Japanese railways is planned by the Bureau of Machinery and Rolling Stock of the Japanese Railway Ministry. The method used would be to lay an additional rail outside the present track, giving two optional gages. The coaches and cars now used on express trains are so built that they can easily be adapted to longer axles. Thus, at first, the expresses would run on the standard gage and the regular trains on narrow gage.

The gage conversion program will not involve adjustment of station platforms, bridges or tunnels, as these were originally built with the expectation of later installing standard gage.

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Railroad Gage Unity Sought in Australia

Australia is moving to end the difficulties caused by the different railway gages, according to a dispatch to the *New York Times*. New South Wales has the standard 4 ft. 8½ in., Victoria, 5 ft. 3 in., Queensland and West Australia, 3 ft. 6 in. and South Australia has both 5 ft. 3 in. and 3 ft. 6 in.

On his way east across the continent from Fremantle, Prime Minister Joseph A. Lyons opened extensions of the Transcontinental Railway from Port August to Port Pirie, South Australia, increasing the standard gage by 56 mi. and giving uniformity for 1,108 mi.